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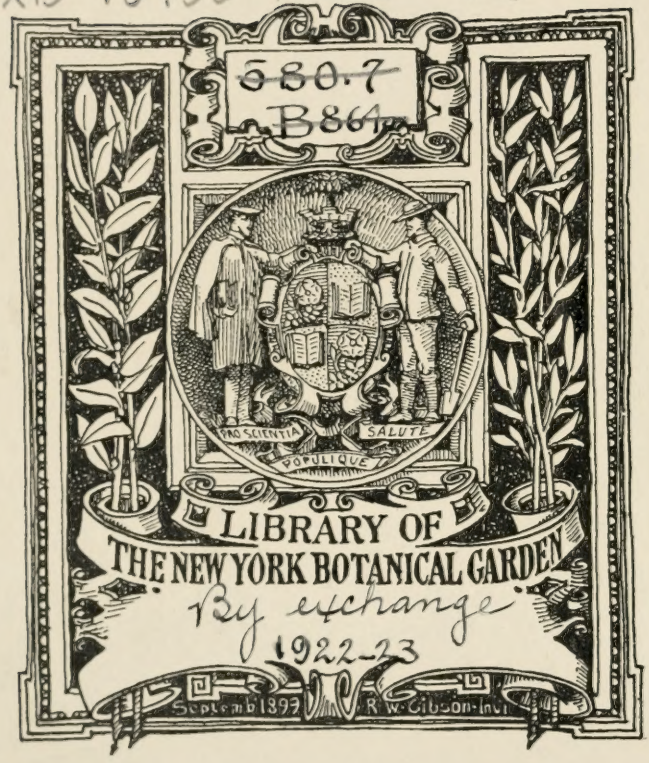

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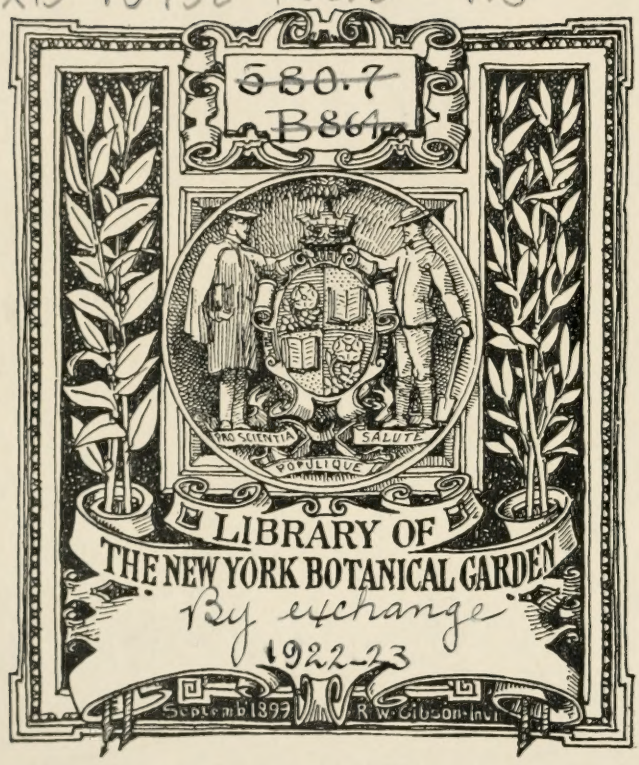

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(„JARDIN BOTANIQUE DE BUITENZORG")

Bulletin du Jardin Botanique

Rédigé par

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Directeur du Jardin Botanique

Dr. F. C. VON FABER,
Chef des Laboratoires Botaniques

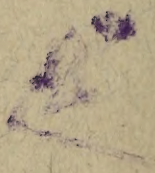
et

Dr. J. J. SMITH,
Chef de l'Herbarier

Série III.—Volume V.

1922—1923.

ARCHIPEL DRUKKERIJ—BUITENZORG.



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„'S LANDS PLANTENTUIN"

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MYKOLOGISCHE MITTEILUNGEN II.

von

ERNST GÄUMANN.

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Die vorliegenden Mitteilungen bilden eine erste Fortsetzung zur Beschreibung indischer Pilze, die ich in dieser Zeitschrift (III, fasc. 2) publiziert habe.

1. **Uromyces Ophiorrhizae** n. sp.

Im Urwald von Tjibodas, z. B. oberhalb Tjibeureum längs des Pfades nach Kandang Badak, sind während der Regenzeit auf Blättern von *Ophiorrhiza longiflora* BL. gelbgrüne bis weissliche, vorgewölbte, bis einen Centimeter grosse Flecken zu finden, die durch einen Uromyces verursacht werden. Die Sporenlager treten auf der Unterseite der Blätter als kleine, weisse Häufchen hervor. Im Zentrum der befallenen Blattpartien sterben die Gewebe ab und verbräunen sich, währenddem peripher stets neue Lager hinzukommen.

Diese Lager enthalten nur Teleutosporen. Diese entstehen auf langen, schlanken Stielen, sind hyalin und besitzen einen im Reifezustand deutlich sichtbaren apikalen Keimporus. Ausnahmsweise sind sie zweizellig (Fig 1). Ohne eine Ruheperiode durchzumachen und auch ohne abzufallen keimen sie schon in den Lagern selbst mit einer dicken, schwach gebogenen Basidie.

Da m. W. auf *Ophiorrhiza* noch kein Uromyces bekannt ist, stellt diese Form eine neue Art dar, für die ich den Namen *Uromyces Ophiorrhizae* vorschlage. Von RACIBORSKI wird in Bull. Acad. Int. Cracovie, 1909, p. 389, auf einer weiss- und grossblumigen *Ophiorrhiza*, also wahrscheinlich unserer Art, ebenfalls von den Hängen des Gedeh, eine *Ascospora Ophiorrhizae* beschrieben. Es ist möglich, dass dieser Pilz nur sekundär auf die primäre *Uromyces*-Infection folgt.

Uromyces Ophiorrhizae n. sp. Soris teleutosporiferis hypophyllis, maculis orbicularibus vel irregularibus, usque 1 cm. latis insidentibus, fere in greges rotundatos dispositis, minutis, compactiusculis, albis. Teleutosporis (fig. 1) globosis, ovatis vel ellipsoideis, apice plerumque rotundatis, hyalinis, 18—24 μ longis, 13—17 μ latis, episporio 2—3 μ crasso; pedicello persistenti, tenui, hyalino, usque 45 μ longo. Habitat in foliis *Ophiorrhizae longiflorae* BL. (Rubiacearum species) in silvis ad montem Gedeh (alt. 1600—2000 m.) insulae Java.

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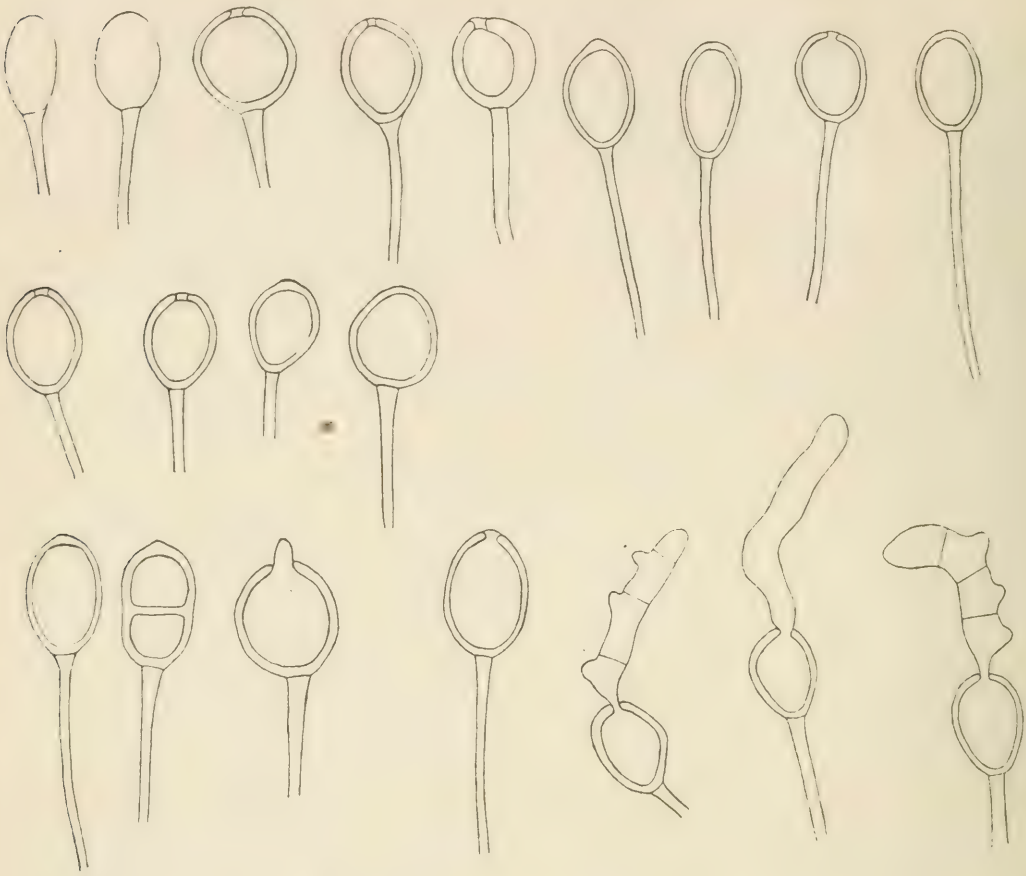

Fig. 1. Teleutosporen und Basidien des *Uromyces Ophiorrhizae* n. sp. (Vergr. 670).

2. **Puccinia tjibodensis** n. sp.

Auch diesen Pilz habe ich, wie den vorhergehenden, in der Regenzeit im Urwald von Tjibodas gefunden und zwar auf *Solanum biflorum* LOUR., z.B. längs des Baches Tjibodas in der Umgebung des Pfades, der zur frühern Försterhütte führt. Er verursacht auf den Blättern kleine, gewöhnlich nur 1—3 Millimeter grosse, braune Flecken, auf deren Unterseite in kreisförmiger Anordnung die weissen oder gelblich-weissen Sporenlager hervorbrechen. Bei nebligem Wetter nehmen diese Sporenlager ein schleimiges Aussehen an.

Die einzige Sporenform, die in diesen Lagern auftritt, sind die Teleutosporen. Diese entstehen auf kurzen, persistenten Stielen, sind hyalin, relativ dünnwandig, meist 30—41 μ lang, 8—11 μ breit (Fig. 2). Ihre Keimung erfolgt ohne Ruhepause und ist, wie man sowohl auf den Wirtspflanzen selbst, als auch in Wasserkulturen verfolgen kann, ziemlich eigenartig. Es entsteht eine dicke, gewöhnlich ziemlich kurze Basidie, die apikal eine

grosse Basidiospore abschnürt, welche wiederum ohne weiteres auch schon auf der Wirtspflanze keimt. Mit dieser einzigen Basidiospore scheint gewöhnlich die Kraft der Basidie erschöpft zu sein. Ausnahmsweise kommt es vor, dass sie durch eine Querwand noch ein unteres Fach abtrennt, welches wiederum eine Basidiospore bildet. Da ich diese Keimungsart sowohl auf der Wirtspflanze selbst als auch regelmässig im hängenden Tropfen sah, ist es nicht ausgeschlossen, dass bei dieser Form die typische Basidie verloren gegangen ist.

Auf der Gattung *Solanum* sind schon mehrere *Puccinia*-Arten beschrieben worden, jedoch noch nicht auf *Solanum biflorum* LOUR. Unsere Art weicht von diesen andern neben ihren andern Dimensionen auch dadurch ab, dass sie hyalin ist. Sie muss daher als neue Art aufgefasst werden, die ich nach ihrem ersten Fundorte *Puccinia tjibodensis* nenne.

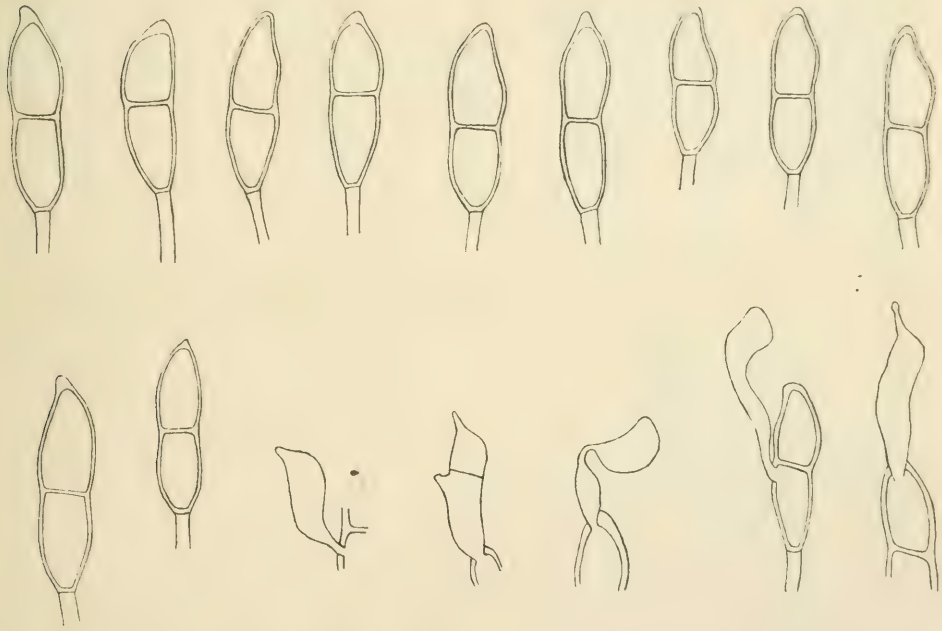

Fig. 2. Teleutosporen und Basidien der *Puccinia tjibodensis* n. sp. (Vergr. 670).

Puccinia tjibodensis n. sp. Soris teleutosporiferis hypophyllis, maculis brunneis, orbicularibus, usque 5 mm. latis insidentibus, rotundatis, albis vel lacteis. Teleutosporis (fig. 2) longe ellipsoideis vel leviter clavatis, apice rotundatis vel leviter acutiusculis, non vel lenisse incrassatis, medio leniter constrictis, basim versus attenuatis, levibus, hyalinis, fere 30—41 μ longis, 8—11 μ latis; pedicello hyalino, firmo, usque 28 μ longo. Habitat in foliis vivis *Solani biflori* LOUR. in silvis ad montem Gedeh in insula Java.

3. **Phakopsora Commelinae** n. sp.

Auf den Blättern von *Commelina nudiflora* L. findet man in der Umgebung von Buitenzorg häufig kleine, ungefähr einen Millimeter grosse, manchmal zusammenfliessende, braune oder braunschwarze Flecken, die von einem hellgrünen Hof umgeben sind. Wird der Anfall zu stark, dann werden die Blätter gelb und fallen vorzeitig ab.

Auf der Unterseite dieser Flecken finden sich in regelmässiger Anordnung als feine, weisse oder im Alter schwach gelblich werdende Pünktchen die Uredosori. Dass es sich wirklich um Uredo handelt, geht daraus hervor, dass die Sporen noch kurz von ihrer Reife zweikernig sind und dass sie mit einem Keimschlauch keimen (Fig. 3). Ihre Form ist ebenfalls aus Fig. 3 ersichtlich. Ihre Länge beträgt 21—30, meistens 24—25 μ, ihre Breite 13—19, meistens 14—15 μ. Ihre Oberfläche ist mit feinen Stacheln besetzt.

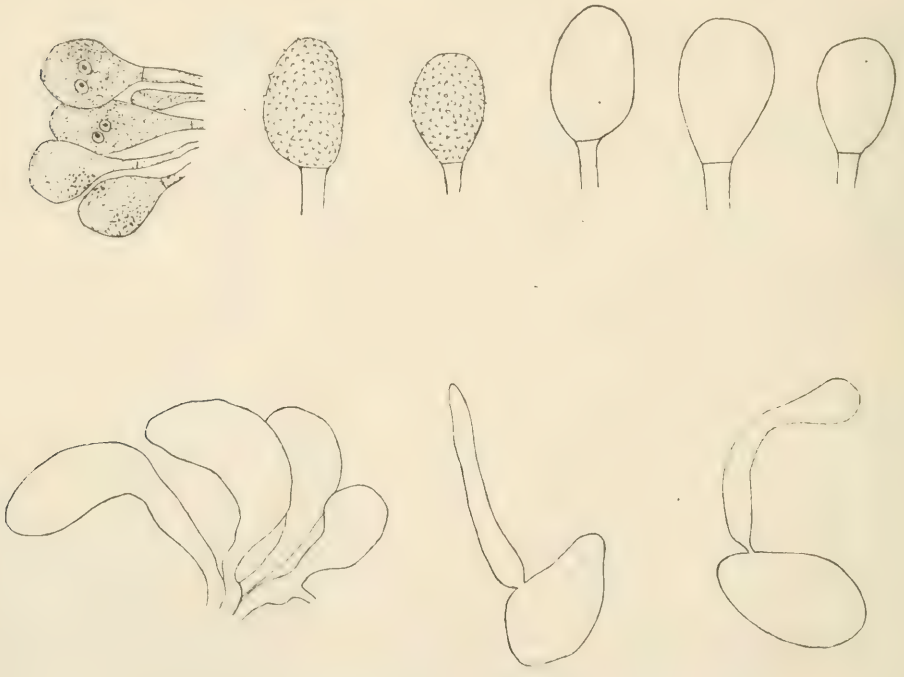

Fig. 3. Junge, ausgewachsene und keimende Uredosporen und Paraphysen der *Phakopsora Commelinae* n. sp. (Die erst- und letztgenannten vergr. 900, die beiden andern vergr. 670).

Obschon ich die Teleutosporen dieses Pilzes trotz vielen Suchens noch nicht habe finden können, ist es wohl kaum zweifelhaft, dass diese Uredoform zur Gattung *Phakopsora* gehört. Sie stimmt ja auch in ihrem Habitus auffallend mit der *Phakopsora Phyllanti* DIET. überein, nur dass ihre Sporen etwas schmäler und länger sind. Sie scheint in Nied. Indien weit verbreitet zu sein; so fand ich sie auch auf Celebes, z. B. in Loka ober-

halb Bonthain, in Oedjoeng Lemoeroe und Amali in der Landschaft Bone und in Boeakajoe und Taoendjamboe in der Landschaft Loewoe.

Phakopsora Commelinae n. sp. Soris uredosporiferis hypophyllis, maculis minutis, obscure brunneis insidentibus, punctiformis, diu epidermide tectis, primum lacteis, dein dilute flavis; uredosporis (Fig. 3) variabilibus, piriformibus vel ovoideis, hyalinis, echinulatis, 21—30, fere 24—25 μ longis, 13—19, fere 14—15 μ latis; paraphysibus numerosis, hyalinis, 32—40 μ longis, 12—14 μ latis. Habitat in foliis vivis *Commelinae nudiflorae* L. in insulis Java et Celebes.

4. Phakopsora Erythrinae n. sp.

Im Cultuurtuin zu Buitenzorg finden sich häufig auf den Blättern von *Erythrina microcarpa* KDS. et VAL. kleine, 1—2 Millimeter messende, schwarzbraune Flecken, die auf der Unterseite in ihrer Mitte ein kleines, weisses oder sehr schwach gelbliches Sporenhäufchen tragen. Merkbaren Schaden richtet der Pilz nicht an, da sich die Infectionen stets auf diese punktförmigen Flecken beschränken.

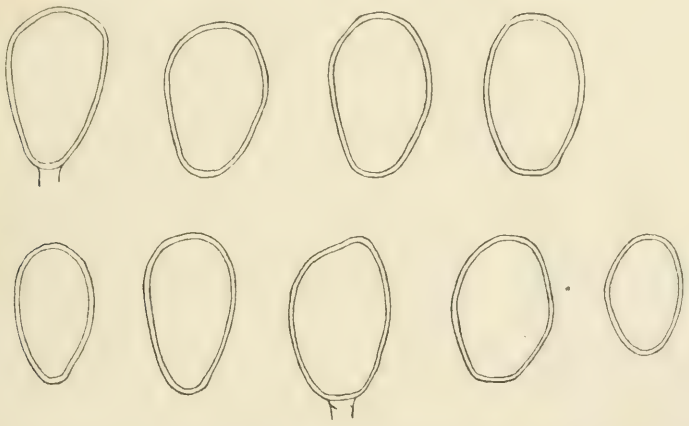

Fig. 4. Uredosporen der Phakopsora Erythrinae n. sp. (Vergr. 670).

Die Sporen dieses Pilzes stimmen, wie aus Fig. 4 ersichtlich ist, in ihrer Form vollständig mit denjenigen der *Phakopsora Commelinae* überein; nur sind sie beträchtlich grösser, nämlich 24—38, meist 30—33 μ lang, 15—26, meist 21—23 μ breit. Auch ihre Oberfläche ist mit feinen Stacheln besetzt.

Obschon ich das Verhalten dieses Pilzes während zweier Jahre sowohl in der Regen- als in der Trockenzeit verfolgt habe, konnte ich, ebenso wie auf *Commelina*, keine Teleutosporen finden. Wenn diese im Klima von Westjava überhaupt gebildet werden, dann geschieht dies sicherlich nur als grosse Ausnahme.

Auch diese Uredoformen möchte ich vorläufig zur Gattung *Phakopsora* stellen und zwar unter dem Namen *Phakopsora Erythrinae*.

Phakopsora Erythinae n. sp. Soris uredosporiferis hypophyllis, lacteis, maculis obscure brunneis, parvis, 1—2 mm. latis insidentibus; uredosporis (fig. 4) hyalinis, piriformibus vel ovoideis vel irregularibus, echinulatis. 24—38, fere 30—33 μ longis, 15—26, fere 21—23 μ latis; paraphysibus numerosis, hyalinis, 35—62 μ longis, 11—16 μ latis. Teleutosporis absentibus. Habitat in foliis vivis *Erythrinae microcarpae* KDS. et VAL in hort. oecon. Bogoriensi in insula Java.

5. Endophyllum Ixorae n. sp.

Unter den zahlreichen Pilzen, die RACIBORSKI aus Java bekannt gemacht hat, beschreibt er auch eine Uredinee auf *Griffitsia fragrans* MIQ. (*Randia Miquelii* KDS. et VAL. pro parte) und *Randia scandens* (BL.) DC., nämlich *Endophyllum Griffitsiae* n. sp., das er für wahrscheinlich identisch betrachtet mit dem *Aecidium Griffitsiae* HENN. Ich fand in dem sekundären Urwald bei Depok ebenfalls ein *Endophyllum* auf *Randia patula* MIQ. und *Randia multiflora* KDS. et VAL., das ich mit dem *End. Griffitsiae* für identisch halten möchte, obschon Versuche über die biologische Specialisation auf diesen vier *Randia*-Arten nicht ausgeführt werden konnten.

Daneben fand RACIBORSKI ebenfalls um Depok auf einer andern Rubiacee, *Pavetta silvatica* BL. (*Pav. indica* L.) noch ein weiteres *Endophyllum* mit Pykniden, das er vorläufig beim *End. Griffitsiae* unterbringt, das aber, wie SYDOW bemerkt, wohl zu einer selbständigen Art erhoben werden dürfte. Trotz vielen Suchens konnte ich diesen Pilz nicht mehr wiederfinden, da die sekundären Wälder durch die Bevölkerung stark geschlagen werden. Jedoch fand ich auf *Ixora javanica* DC. (*Pavetta pauciflora* BL.) ein *Endophyllum*, das von diesen beiden verschieden zu sein scheint.

Der Pilz bildet auf den Blättern gewöhnlich 2—3 cm. grosse, erst hellgrüne, später schmutzig-braune, schwach vorgewölbte Flecken, die auf der Unterseite über und über von Sporenhäufchen besetzt sind. Manchmal überzieht er die Blätter auch ganz und bringt sie zum vorzeitigen Absterben. Die Teleutosporenlager werden tief im Blattgewebe angelegt und sind zur Reifezeit selbst an der Blattoberfläche als eine schwache Wölbung sichtbar. Ihr Durchmesser beträgt im allgemeinen 200—300 μ. Die Wände der Peridienzellen (Fig. 5) sind allseitig ungefähr gleich dick und mit feinen, stachelförmigen Sculpturen besetzt.

Die Teleutosporen sind länglich, mit abgerundeten Ecken, meist 17—21 μ lang, 12—15 μ breit. Ihre Oberfläche ist ebenfalls mit feinen Stacheln besetzt. Sie keimen in Wasser ziemlich reichlich, haben aber die Eigentümlichkeit, dass die Basidien gewöhnlich nur eine Querwand besitzen. So wie RACIBORSKI es für *Endophyllum Griffitsiae* erwähnt, geschieht es auch bei dem vorliegenden Pilze öfters, dass die Sterigmen sich gabeln. Nur scheinen hier im Gegensatz zu *End. Griffitsiae* beide Gabeläste nacheinander eine Basidiospore abschnüren zu können.

Fig. 5. Peridienzellen, Teleutosporen und Basidien des *Endophyllum Ixorae* n. sp. (Vergr. 670).

Wie schon oben gesagt, scheint mir dieser Pilz neu zu sein. Von dem *End. Griffitsiae* auf *Randia* unterscheidet er sich durch die schmälern und daher länglichern Teleutosporen. Von dem andern, noch nicht näher beschriebenen *Endophyllum* auf *Pavetta indica* unterscheidet er sich schon durch die Abwesenheit der Pykniden. Als Namen möchte ich vorschlagen *Endophyllum Ixorae.*

Endophyllum Ixorae n. sp. Soris teleutosporiferis hypophyllis, maculis rotundatis vel irregularibus, hypertrophicis, usque ad 3 cm. latis insidentibus, immersis, rotundatis, 200—300 μ diam., peridio (fig. 5) dense verrucoso. Teleutosporis (fig. 5) angulato-ellipsoideis vel globosis, dense minutissimeque verruculosis, flavidis, fere 17—21 μ longis, 12—15 μ latis. Habitat in foliis vivis *Ixorae javanicae* DC. in insula Java.

6. Uromyces Phlogacanthi n. sp.

Der Fund dieses *Uromyces* hat eine ähnliche Geschichte wie sie RACIBORSKI erzählt für einen der Pilze, die er auf Java entdeckte, dass er nämlich beim Suchen nach einem parasitischen Pilz auf eine neue Phanerogamenart gestossen war. So fand ich im Juli des vergangenen Jahres in einer Bachrinne zwischen Bitoembang und Gantarang auf der Insel Saleier (südlich von Celebes) einen Rostpilz auf einer Acanthacee mit schmutzig braun-violetten Blüten, von der ich einiges Material zur Verification mitnahm. Später sah ich den gleichen Rostpilz auf der gleichen Wirtspflanze in einem Sumpfwald auf der Insel Palette im Golf von Bone wieder und schliesslich, vermischt mit einem Aecidium, in einem Gebüsch an Westhange des Tales des WalanaE, am Fusspfad von Bontorihoe nach Tjani.

Bei der Bestimmung der Wirtspflanze durch Herrn C. A. BACKER, Botaniker für die Javaflora am Herbarium in Buitenzorg, stellte es sich heraus, dass es sich um eine höchst wahrscheinlich neue Art der sonst hauptsächlich centralasiatischen Gattung *Phlogacanthus* handelte. Da Herr BACKER aber mit der weitern Bearbeitung und Beschreibung dieser Art zuwarten will, bis die Acanthaceen für die Javaflora an die Reihe kommen werden, hat er mir für sie den Manuskriptnamen *Phlogacanthus celebicus* BACKER gegeben, wovon also das Originalmaterial im Buitenzorger Herbar der weitern Bearbeitung harrt.

Fig. 6. Teleutosporen des *Uromyces Phlogacanthi* n. sp. (Vergr. 670).

Auf den Blättern des *Phlog. celebicus* verursacht unser Pilz bis 2 cm. messende, dunkelbraune, mit einem hellgrünen Hof umgebene Flecken, die auf der Unterseite über und über von den Sporenhäufchen besetzt sind. Die Teleutosporen stehen dicht in kleinen, halbkugeligen Lagern beieinander. Sie sind kastanienbraun, glatt, in ihrer Gestalt ziemlich unregelmässig, meist mehr oder weniger kugelig oder umgekehrt eiförmig, oft beinahe keulenförmig, da häufig die Spore in den Stiel herabläuft. An der Spitze ist gelegentlich ein Keimporus sichtbar. Sie sind 23—30, meist 26—28 μ lang, 20—25, meist 21—23 μ breit. Ihre Wand ist deutlich zweischichtig. Ihre Stiele sind dauerhaft, schwach braun und 2—3 Mal so lang als die Spore selbst.

Neben diesen typischen Uromyces-Teleutosporen findet man in den Präparaten gelegentlich auch noch zweizellige Sporen, die gewöhnlich etwas dunkler sind, ebenfalls glatt und von unregelmässiger Gestalt. Sie sind meist etwas kleiner als die normalen Teleutosporen, nämlich 20—23 μ lang, 16—17 μ breit.

Da m. W. auf der Gattung *Phlogacanthus* noch kein Rostpilz beschrieben ist, stellt die vorliegende Form eine neue Art dar, für welche ich folgende Fassung vorschlage.

Uromyces Phlogacanthi n. sp. Soris teleutosporiferis hypophyllis, maculis pallescentibus, deinde brunneis insidentibus, pulverulentis, castaneis. Teleutosporis (Fig. 6) subglobosis vel ovatis vel oblongo-clavatis, rarissime septatis, apice papillula minutissima instructis, basi attenuatis, levibus, castaneis, 23—30, fere 26—28 μ longis, 20—25, fere 21—23 μ latis; pedicello persistenti, crasso, flavo, usque 80 μ longo. Habitat in foliis vivis *Phlogacanthi celebici* BACKER (Acanthacearum spec.) in insulis Saleier, Palette nec non Celebes Indiae.

7. Aecidium Phlogacanthi n. sp.

Neben dem *Uromyces Phlogacanthi* fand ich auf *Phlogacanthus celebicus* ein einziges Mal und auch da nur auf zwei Blättern ein Aecidium, und zwar an dem oben beschriebenen Standort an den Talhängen des WalanaE. Obschon das gleiche Blatt auch in beiden Fällen durch den Uromyces befallen war, ist es nicht wahrscheinlich, dass die beiden in einem genetischen Zusammenhange miteinander stehen; sonst hätte sich dieser auch in der Anordnung der Lager äussern müssen. Zuden wäre nicht leicht einzusehen, warum dann bei den zahlreichen befallenen Pflanzen an den andern Standorten (und selbst bei den andern Pflanzen am gleichen Standorte) keine Spuren eines Aecidiums zu finden gewesen wären. Ich führe es daher von dem Uromyces getrennt auf.

Die Aecidien stehen in einer beinahe einen Centimeter messenden Gruppe ziemlich dicht gedrängt beieinander. Ihr Durchmesser ist ziemlich klein, meist nicht mehr als 150 μ. Die Peridie ist an der Innenwand etwas dicker als an der Aussenwand (Fig. 7) und an ersterer mit kräftiger Stabchenstruktur versehen.

Fig. 7. Peridienzellen und Accidiosporen des *Aecidium Phlogacanthi* n. sp. (Vergr. 670).

Die Aecidiosporen sind leicht punktiert, kugelig oder meist etwas länglich, meist 18—23 μ lang, 14—18 μ breit.

Aecidium Phlogacanthi n. sp. Aecidiis amphigenis, gregariis, conspicuis, fere 100 μ diam., tenuibus, peridio e cellulis firme conjunctis grosse verruculosis; sporis globosis vel ellipsoideis, minutissime verruculosis, fere 18—23 μ longis, 14—18 μ latis (Fig. 7). Habitat in foliis vivis *Phlogacanthi celebici* BACKER in insula Celebes.

8. Puccinia celebica n. sp.

Auf *Borreria laevis* GRISEB. fand ich auf einem Schuttplatz bei Bikeroe an der Oostküste von Südcelebes eine Puccinia, die wahrscheinlich für die Wissenschaft neu ist. Sie bildet auf den Blättern sehr kleine, nur ausnahmsweise bis etwa einen halben Centimeter grosse, braune Flecken, die auf der Unterseite von den mehr oder weniger concentrisch stehenden, anfänglich gelbbraunen, in der Reife kastanienbraunen Sporen-lagern bedeckt sind.

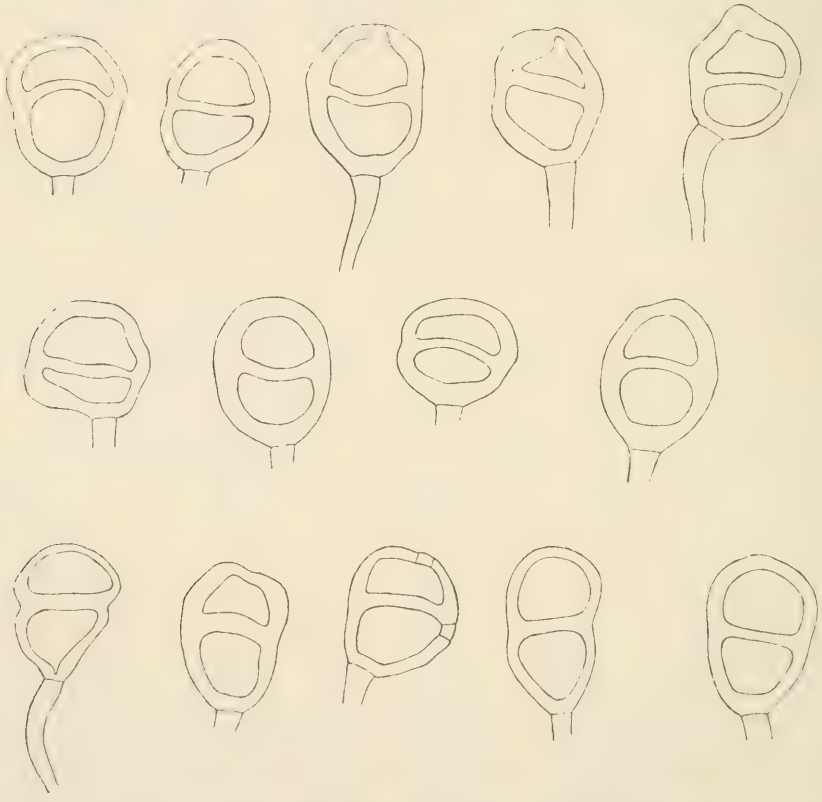

Fig. 8. Teleutosporen der *Puccinia celebica* n. sp. (Vergr. 670).

Die Teleutosporen (Fig. 8) sind von sehr unregelmässiger Gestalt, gelegentlich ebenso breit oder selbst noch breiter als lang, meist 25—33 μ lang, 20—26 μ breit, mit dickem, glatten hellbraunem Epispor. Der Stiel ist persistent und ziemlich kurz, meist nur 33—50 μ lang.

Diese Art unterscheidet sich von der afrikanischen *Puccinia Borreriae* SYDOW auf *Borreria angustifolia* durch ihre kleineren und rundern Teleuto-

sporen, währenddem auf einer andern *Borreria*-Art m. W. noch keine *Puccinia* beschrieben ist. Dagegen dürfte sie mit der *Pucc. brevispora* RAC. auf *Spermacoce spec.* aus Java nahe verwandt sein, was man aber nur an Hand der Originalmaterialien entscheiden könnte. Immerhin ist schon mit Rücksicht auf die systematische Stellung der Wirtsgattungen eine Identität der beiden Pilze kaum wahrscheinlich, weshalb ich für meine Form den Namen *Puccinia celebica* vorschlage.

Puccinia celebica n. sp. Soris teleutosporiferis hypophyllis, maculis parvis, brunneolis insidentibus, plerumque secus orbem dispositis, minutis, castaneis; teleutosporis (Fig. 8) irregularibus, oblongis vel ovoideis, apice rotundatis, medio vix vel haud constrictis, basi plerumque rotundatis, flavis, levibus, 25—33 μ longis, 20—26 μ latis, episporio tenui, crasso, pedicello persistenti, plerumque brevi. Habitat in foliis vivis *Borreriae laevis* GRISEB. in insula Celebes.

ORCHIDACEAE NOVAE MALAYENSES X.

Auctore

J. J. Smith.

Peristylus tobensis J. J. S. n. sp.

Tubera subovalia, sicco c. 0.5—0.6 cm. longa. Caulis hypogaeus interdum elongatus et ad nodos radicans, ad c. 2 4 cm. longus. Caulis epigaeus brevis. Folia pauca, basilaria, oblonga, apicem versus angustata, c. 3 cm. longa; vaginae breves, tubulosae. Inflorescentia erecta, densius multiflora, pedunculo c. 12—17.5 cm. longo, vaginulis c. 4 foliaceis apicem versus decrescentibus in bracteas vergentibus donato, rachide c. 2.5—4.5 cm. longa. Bracteae anguste ovato-lanceolatae, sensim angustatae, inferiores ad c. 0.85—1 cm. longae (sicco), superiores minores. Sepalum dorsale oblongum ad lanceolatum, acuminatum, marginibus incurvis apiculatum, bene concavum, 1—3nervium, costa media dorso prominente, c. 0.5—0.75 cm. longum, 0.14—0.2 cm. latum. Sepala oblique anguste lanceolata, falcatula, sensim acuminata, apice marginibus incurvis apiculata, canaliculata, nervo 1 dorso prominulo, c. 0.5—0.7 cm. longa, 0.13—0.16 cm. lata. Petala basi obliqua ungui labelli adnata, oblique subelliptica, longe acuminata, acuta, concava, 1nervia cum nervo laterali 1 utrinque, c. 0.5—0.65 cm. longa, 0.17—0.2 cm. lata. Labellum basi gynostemio et basi petalorum adnatum, calcaratum, unguiculatum, apice recurvum, concavum, 3nervium, explanatum absque calcari c. 0.48 cm. longum, ungue conspicuo, subovali-oblongo, concavo, intus infra apicem callo conspicuo conico porrecto instructo, subtus late convexo-tricostato, c. 0.28 cm. longo, 0.18 cm. lato, lamina trifida, laciniis lateralibus divergentibus, incurvis, oblique oblongis, margine antico subrectis, margine postico plus minusve rotundatis et crenulato-repandulis, c. 0.14—0.16 cm. longis, fere 0.1 cm. latis, lacinia intermedia lateralibus longiore et angustiore, obtusa vel acuta, c. 0.17 cm. longa, bene 0.05 cm. lata, calcari ovario parallelo reverso, cum labello angulum obtusum faciente, ovoideo, acuminato, subacuto, c. 0.2 cm. longo. Gynostemium cum ovario angulum obtusum faciens, c. 0.2—0.25 cm. longum, auriculis dimidium gynostemii vix superantibus, gynostemio adpressis, oblongis, truncatis. Anthera gynostemium continua, thecis parallelis, contiguis, extus convexis, connectivo costiformi, apice in rostrum obtusangule incurvulum apice subrecurvulum triangulum producto. Rostelli lobus intermedius arcte conduplicato-triangulus, acutus. Ovarium tortum, 6sulcatum, c. 0.575—1 cm. longum.

Sumatra: Bataklanden, Toba lake, 1450 m. (O. HAGERUP n. 7 pp., 1916—1917).

Differing from *P. candidus* J. J. S. in the smaller flowers with a longer spur and a callus on the lip, and from *P. tentaculatus* J. J. S. in the larger flowers with very short side laciniae of the lip.

Description from herbarium specimens the leaves of which were all in a bad state.

Platanthera angustata LNDL. Gen. et sp. Orch. (1835), 290; etc.
var. **singgalangensis** J. J. S. n. var.

Rhizoma brevissimum, radicibus crassis, villosis. Folia radicalia erecta, petiolata, ovata, vix acuminata, apiculata, basi longe in petiolum contracta, curvinervia, in utraque parte costae mediae supra canaliculatae subtus valde carinatae nervis c. 3 majoribus et nonnulis tenuibus, reticulato-venosa, c. 9—10 cm. longa, 5—5.5 cm. lata, basi contracta c. 3—4 cm. longa; petiolus canaliculatus, c. 6.5—9.5 cm. longus, basi vaginis tubulosis obtectus. Inflorescentia erecta, laxe multiflora, pedunculo c. 30—40 cm. longo, basi nonnullis vaginulis tubulosis superioribus accrescentibus ad c. 6—7 cm. longis obtecto, deinde vaginis foliaceis c. 2—4 sessilibus amplexicaulibus vel fere amplexicaulibus marginibus et costa media decurrentibus ovatis acute acuminatis superne decrescentibus et in bracteas vergentibus ad c. 4.5—6.25 cm. longis donato, rachide saepe plus minusve serpentina, bractearum marginibus et costa media decurrentibus plus minusve angulata, c. 13—20 cm. longa. Bracteae ovatae, acuminatae, acutae, basi decurrentes, supra in utraque parte costae mediae canaliculatae convexae, ad c. 1.65 cm. longae, 0.8 cm. latae. Flores carnosuli, c. 0.7 cm. lati, cum calcari c. 2.4 cm. longi. Sepalum dorsale erectum, cum petalis galeatum, late ovatum, obtusum, concavum, nervis 3 dorso prominulis, c. 0.75 cm. longum, 0.55 cm. latum. Sepala lateralia oblique reflexa, apice recurva, convexa, oblique oblonga, margine interiore rotundata, obtusa, nervis 3 dorso prominulis, c. 0.875 cm. longa, 0.4 cm. lata. Petala sepalo dorsali leviter agglutinata, oblique subsemiovata, apice leviter contracta, obtusa, retusa, margine antico inferne rotundata, basi fauci calcaris et basi gynostemii adnata, 2nervia, c. 0.75 cm. longa, 0.36 cm. lata. Labellum recurvum, cum gynostemio angulum subrectum faciens, fauci calcaris basi gynostemii adnatum, late lineare, apicem versus vix angustatum, obtusum, basi utrinque leviter obtusangule dilatatum, convexum, c. 0.95 cm. longum, basi 0.35 cm., medio 0.25 cm. latum; calcar deflexum, leviter incurvulum, subteres, sectione transversa ellipticum, apicem versus attenuatum, anguste obtusum, c. 1.7 cm. longum. Gynostemium latum, cum ovario angulum obtusum faciens, lateraliter compressum, dorso convexum, c. 0.4 cm. longum, 0.35 cm. latum, auriculis in medio gynostemii marginum anticorum, semilunatis, verruculosis. Anthera magna, lata, connectivo lato hippocrepiformi-curvato, apice oblique truncato spurie rotundato-exciso, thecis remotis, clavatis, basi divergentibus, lateraliter compressis,

apice rotundatis. Rostellum transversum, latum, lobo intermedio obsoleto angustissimo. Stigma late transverse oblongum. Ovarium patens, apice incurvulum et attenuatum, tortum, obtuse trigonum, costis 3 validis et 3 obsoletis sed in rostro conspicuis, c. 1.6 cm. longum.

Sumatra: West coast, Goenoeng Singgalang, 2800 m., in underbrush, common. (H. A. B. BÜNNEMEIJER n. 2871, June 1918). As quoted, fan along the lake on the summit, 2870 m. (S. LEEFMANS n. 16, April 1918). Laras Talang, Boekit Gombak, 2200 m. (H. A. B. BÜNNEMEIJER n. 5716, November 1918).

The texture of the flowers seems to have been somewhat more fleshy than in the Javanese specimens. Moreover the sepals, petals and lip are less narrowed towards the tip, the connective is narrower, the auricles of the column smaller and the midlobe of the rostellum still more obsolete.

All the flowers of n. 5716 are very much damaged, but I think it belongs here.

The flowers are said to be green.

Description from herbarium and part of an inflorescence preserved in alcohol.

Cryptostylis conspicua J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 247.

var. **sumatrana** J. J. S. n. var.

Folia erecta, longe petiolata, oblique ovata ad elliptico-ovata, acute acuminata, basi breviter acute in petiolum contracta, sicco membranacea, c. 14—22 cm. longa, 6.75—9.5 cm. lata; petiolus 11—19 cm. longus. Inflorescentiae validae, pedunculo c. 39—54 cm. longo, vaginis c. 6 longis tubulosis acutis ad c. 5—9 cm. longis donato, vaginis inferioribus approximatis brevioribus obtusis apiculatis, rachide c. 18—36 cm. longa, 17—36flora. Bracteae ovato-triangulae, longe acuminatae, c. 1.5—2.6 cm. longae. Flores majusculi, erecti. Sepalum dorsale explanatum anguste lanceolatum, acutum, apiculatum, c. 1.9 cm. longum, 0.4 cm. latum. Sepala lateralia explanata lineari-lanceolata, anguste obtusa, breviter apiculata, c. 1.9 cm. longa, 0.35 cm. lata. Petala lineari-lanceolata, acute acuminata, c. 0.95 cm. longa, 0.18 cm. lata. Labellum convexum, basi medio fere usque medium alte cucullatum, cucullo anguste oblongo, dorso longitudinaliter late 3costata, parte superiore cum cucullo angulum obtusum faciente, carnosulum, inexplanatum ambitu ellipticum, acutum, basi minute biauriculatum, 2.5 cm. longum, 1.35 cm. latum, explanatum subovato-triangulum, basi truncatum, 1.6 cm. latum. Gynostemium cum ovario angulum subrectum faciens, dorso convexum cum canalicula longitudinali, clinandrio magno, apice lato bilobo, utroque latere trilobulo, lobulis 2 obtusis, lobulo inferiore (auricula) dentiformi triangulo. Anthera ovato-cordata, obtusa, brevissime obtuse subrecurvule conico-apiculata, basi thecarum dimidio interiore basi breviter producto

bilobula, c. 0.26 cm. longa. Stigma prominens, utroque latere convexum cum marginibus recurvis. Ovarium c. 1.4 cm. longum. Capsula erecto-patens, flore marcedo coronata, fusiformis, basi brevissime pedicellato-contracta, 6costata, c. 2.2 cm. longa, rimis 6 dehiscens.

Sumatra: West coast, Goenoeng Malintang, 1900 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 3933 and 4057, July 1918). Goenoeng Sago, 1800—2000 m., not rare. (H. A. B. BÜNNEMEIJER nrs. 4012 and 4355, July and August 1918).

The variety differs chiefly in the colouring of the flowers which are described by the author as green, the lip being very faintly veined with violet.

Description from numerous dried plants and part of an inflorescence preserved in alcohol.

Aphyllorchis sumatrana J. J. S. n. sp.

Rhizoma verticale, breve, brevinode, vaginis brevibus tubulosis rumpentibus, radicibus horizontalibus crassis villosis. Inflorescentia erecta, elongata, laxe multiflora, pedunculo furfuraceo, c. 20—53 cm. longo, vaginulis c. 7—8 tubulosis obtusis furfuraceis ad c. 1.25—1.75 cm. longis donato, rachide furfuracea, c. 9—15.5 cm. longa. Bracteae oblongae, obtusae, furfuraceae, ad c. 0.5—0.7 cm. longae. Flores c. 1 cm. lati, 1.1 cm. longi, sepalis dorso verruculosis et parce furfuraceis petalisque incurvis. Sepalum dorsale erectum, valde cymbiformi-concavum, oblongum, apice angustatum, obtusum, brevissime apiculatum, nervis 3 dorso prominulis, bene 0.9 cm. longum, 0.325 cm. latum. Sepala lateralia decurva, oblique cymbiformi-concava, falcato-oblonga, obtusa, nervis 3 dorso prominulis, c. 0.725 cm. longa, 0.32 cm. lata. Petala falcato-oblonga, obtusa, interdum apiculata, irregulariter marginata, leviter concava, 3nervia, costa media dorso valde prominente, c. 0.75 cm. longa, 0.25 cm. lata. Labellum 3lobum, ambitu oblongum; hypochylium cum ovario angulum acutum, cum gynostemio angulum obtusum faciens, subquadratum, apicem versus paulo dilatatum, carnosum, basi crassissimum, apicem versus attenuatum, sectione longitudinali triangulum, c. 0.23 cm. longum, 0.225 cm. latum; lobi laterales parvi, basilares, erecti, paralleli, facie interiore disco adnati, oblique trianguli, margine antico angusto liberi, obtusi; epichylium membrana transversa tenui 5nervia elastice insertum, simplex, infra medium valde recurvum et leviter constrictum, carnosum, marginibus erectis basin versus paulo dilatatis rotundatis et irregulariter crenulatis concavum, marginibus infra apicem incurvis contiguis cucullatum, cuculli apice trigono-conico obtuso, extus superne utrinque rugulosum, lateribus intus apice et margine angusto exceptis valde convexo-incrassatum et verrucoso-rugosum, fere 0.6 cm. longum, basi 0.3 cm. latum. Gynostemium longiusculum, vix curvulum, apice non dilatatum, dimidio inferiore subteres, costula longitudinali ab auricularum margine antico decurrente utrinque, dorso ad apicem longitudinaliter bisulcatum, 0.525 cm. longum,

clinandrio alte bipartito, lobis (auriculis) conspicuis, sinu truncato sejunctis, triangulis, obtusis, leviter concavis, anthera paulo brevioribus. Anthera cucullata, selliformis, connectivo crasso convexo lateraliter compresso, marginibus latis deflexis margine ultimo incurvulis, apice late rotundato-biloba, c. 0.13 cm. longa. Rostellum porrectum, cum ovario angulum acutum faciens, auriculis multo brevius. Stigma longitudinale, obverse oblongo-triangulum, margine elevatum, fere usque medium gynostemii decurrens. Ovarium curvulum, obtuse trigonum, alte 6sulcatum, verruculosum, parce furfuraceum, c. 1.1 cm. longum; pedicellus tortus, 0.45 cm. longus.

Sumatra: West coast, Goenoeng Malintang, 1300 m., in forest. (H. A. B. BÜNNEMEIJER n. 4041, July 1918).

A species with the epichyl of the lip simple, much recurved and rugose outside towards the apex and inside, and a rather long column hardly dilated at the apex.

„Peduncle, bracts and flowers light green with violet streaks". (BÜNNEMEIJER).

Description from herbarium and flowers preserved in alcohol.

Galeola ternatensis J. J. S. n. sp.

Caulis elongatus, validus, scandens, inferne vaginatus, superne ad basin ramulorum secundariorum foliatus, e nodis unam radicem satis elongatam emittens. Folia obovato-elliptico-oblonga, sicco apice marginibus incurvis contracta, obtusa, ad c. 7.5 cm. longa, 2.75 cm. lata (sicco), superiora minora. Inflorescentia ampla, terminalis, bene ramosa, laxe paniculata, ramis inferioribus in axilla foliorum et squamarum, ramulis ultimis patentissimis racemosis densius multifloris, diu flores gignentibus, pedunculo c. 1.25—5.75 cm. longo suffultis, rachide incrassata, tereti, c. 1—1.5 cm. longa. Bracteae quaquaversae, minimae, patentes, triangulae, acutae, concavae, 0.07 cm. longae, persistentes. Flores in racemis singuli expansi, mediocres. Sepalum dorsale anguste oblongum, apicem versus sensim dilatatum, apice breviter angustatum, obtusiusculum, apice recurvulum et late canaliculatum, 7- supra basin 9nervium, fere 2.2 cm. longum, 0.65 cm. latum. Sepala lateralia superne recurva, oblique oblonga, subfalcatula, obtusa, basi breviter angustata, supra basin 8—9nervia, bene 2 cm. longa, 0.775 cm. lata. Petala anguste lanceolata, falcatula, apicem versus sensim leviter dilatata, obtusa, angulato-convexa cum costa longitudinali, dorso canaliculata, 5nervia, c. 2.2 cm. longa, 0.5 cm. lata. Labellum basi brevissime unguiculata basi gynostemii adnatum, concavum, subsimplex, explanatum ambitu cuneato-quadrangulo-orbiculare, $^2/_5$ partibus superioribus paulo dilatatum rotundatum et crispato-undulatum, parte inferiore irregulariter repandulum, parte inferiore lamellis creniformibus plus minusve transverse seriatis instructum, lamellis in parte antica densioribus et

longioribus, crista conspicua utrinque ad basin, costa longitudinali valida duplici e basi usque bene $^2/_3$ partes supra basin deinde decrescente simplici et usque apicem producta, subtus longitudinaliter sulcatum, totum c. 1.9 cm. longum, fere 1.4 cm. latum, hypochylio 1.25 cm. longo, fere 1.4 cm. lato. Gynostemium gracile, sigmoideum, leviter a dorso compressum, apicem versus incrassatum, c. 1.25 cm. longum, clinandrio magno, alte excavato, pariete postico producto lato truncato, apicem versus utrinque minutissime serrulato. Anthera magna, cucullata, a latere visa triangula, antice quadrata, apice retusa et medio minute fimbriato-serrulata. 0.25 cm. lata. Rostellum recurvum, triangulum. Stigma transversum, triangulum. Ovarium 6sulcatum, c. 1.2 cm. longum.

Ternate: Toramadiahi, c. 800 m. (V. M. A. BEGUIN, n. 1121, November 1920).

Near *G. vanilloides* SCHLTR. and *G. affinis* J. J. S. From the first species it differs in the colour of the flowers, the petals being grooved on the back (SCHLECHTER in his description says „petalis . . . . . nervo medio extus incrassato"; I suppose that this in an error as in all species of *Galeola* I know the petals are grooved on the back), a much broader lip with the keel produced unto the apex but simple and less conspicuous in the upper third part. From *G. affinis* J. J. S. it may be distinguished by the much broader lip not or hardly retuse at the apex, the clinandrium being very minutely serrulate at the margin and the retuse anther. The three species want to be studied from good flowers preserved in alcohol.

„Terrestrial, climber, 4 m. high. Leaves only on the flowering branches. Flowers yellow, lip red, inside with erect hairy red organs with a light yellow tip." (V. M. A. BEGUIN).

Description from herbarium.

Erythrodes amboinensis J. J. S. nom. nov. — *Physurus herpysmoides* K. et P. var. *amboinensis* J. J. S. Orch. Ambon (1905), 10.

The species differs from *E. herpysmoides* (K. et P.) SCHLTR. a.o. in the much smaller flowers and the shorter spur.

Erythrodes brevicalcar J. J. S. n. sp.

Caulis e basi decumbente tereti radicante c. 12.5 cm. longa adscendens, parte erecta c. 5.5 cm. longa, c. 4folia. Folia oblique oblongo-ovata, subfalcatula, leviter acuminata, acuta, basi breviter in petiolum contracta, undulata, nervis 4 majoribus supra impressis subtus prominentibus, c. 6—6.5 cm. longa, 2.8—3 cm. lata, summum minus; petiolus tenuiusculus, canaliculatus, cum vagina brevi tubulosa c. 2.5—2.7 cm. longus. Inflorescentia erecta, laxe satis multiflora, pedunculo glandulosa-piloso, c. 1.35 cm. longo, vaginulis c. 4 basi tubulosis adpressis superioribus tantum glanduloso-pilosis

ad c. 2.4 cm. longis donato, rachide glanduloso-pilosa, c. 7.5 cm. longa. Bracteae adpressae, lanceolato-triangulae, sensim longe acuminatae, acutae, concavae, dorso glanduloso-pilosae, 1nerviae, c. 0.75 cm. longae. Flores erecti, parvi, c. 0.6 cm. longi, sepalis dorso sparse glanduloso-pilosis. Sepalum dorsale erectum, oblongum, dimidio superiore fere angustatum, obtusum, concavum, 3nervium, c. 0.46 cm. longum, fere 0.2 cm. latum. Sepala lateralia erecto-patentia, oblique subovato-oblonga, apice angustata, obtusiuscula, concava, 3nervia, c. 0.46 cm., margine antico 0.52 cm. longa, 0.225 cm. lata. Petala sepalo dorsali leviter agglutinata, $^2/_5$ partibus superioribus marginibus proximis firme conglutinatis, oblique spathulata, convexa, apice incurvula, 2nervia, ungue cuneato-oblongo, sensim in laminam oblique rhombeo-ovatam obtusam dilatato, tota c. 0.43 cm. longa, lamina c. 0.25 cm. longa, 0.17 cm. lata, ungue basi 0.05 cm. lato. Labellum breviter calcaratum, subtus visum totum ambitu oblongum, subtus longitudinaliter sulcatum, apice recurvum, inexplanatum c. 0.5 cm. longum, lamina usque ad apicem ovarii c. 0.3 cm. longa, parte inferiore ventricosa quam calcar latiore, marginibus incurvis superne leviter recurvulis gynostemio utroque latere adpressa, utrinque sulco excepto verruculoso-callosa, inexplanata c. 0.225 cm. lata, apice constricta deinde in laminam (lobum intermedium) recurvam canaliculatam obtusangule triangulam vix undulatam explanatam bene 0.1 cm. longam 0.26 cm. latam dilatata; calcar ovario adpressum, breve, crassum, omnino alte longitudinaliter sulcatum, obtuse 2lobulum, c. 0.2 cm. longum, 0.175 cm. latum. Gynostemium subrectum, basi contractum, marginibus conspicue rotundato-dilatatis, c. 0.33 cm. longum, clinandrio alte oblique cucullato, marginibus ad basin rostelli dentem obtusangulum formante. Anthera inferne in clinandrium immersa, ambitu elongato-triangula, acuta, basi altius biloba, dimidio inferiore connectivo convexo-incrassata, parte antica plana, c. 0.25 cm. longa. Glandula polliniorum oblonga. Rostellum elongatum, concavum, 2fidum, laciniis oblongo-triangulis, subfalcatis, subacutis. Stigma longitudinale, quinquangulare. Ovarium curvulum, 6sulcatum, sparse glanduloso-pilosum, c. 0.9 cm. longum.

Sumatra: West coast, Agam, Boekit Batoe Banting. (W. GROENEVELDT, Fort de Kock, cult. sub n. 1118).

A distinct species with small flowers, the lip callous on both sides, without ridges and with a very short spur.

Description from a single plant preserved in alcohol.

Anoectochilus longicalcaratus J. J. S. n. sp.

Caulis e basi decumbente radicante c. 6—15 cm. longa adscendens, parte erecta c. 4—6 cm. longa, 4—9folia. Folia oblique subovata vel suborbicularia, breviter acute acuminata, basi late cuneata vel late rotundato-truncata, minute undulata, 5nervia, c. 2.4—4.5 cm. longa, 1.9—3.2 cm. lata; petiolus canaliculatus, cum vagina tubulosa c. 1.2—1.4 cm. longus. Inflore-

scentia erecta, apice laxe 2–4flora, pedunculo glanduloso-piloso, c. 10–15 cm. longo, vaginulis c. 3 in bracteas vergentibus ad c. 1.2 cm. longis donato, rachide glanduloso-pilosa, c. 1.8–3.2 cm longa. Bracteae ovario adpressae, oblongo-triangulae, acute acuminatae, concavae, dorso puberulae, 1nerviae, ad c. 1.3 cm. longae. Flores conspicui, c. 2.2 cm. lati, 2.5 cm. longi, sepalis dorso patentissime glanduloso-pilosis. Sepalum dorsale horizontale, apice recurvulum, late subelliptico-ovatum, acuminatum, obtusum, valde concavum, 1nervium, c. 1.2 cm. longum, 0.575 cm. latum. Sepala lateralia divergentia, apice recurva, basi basin calcaris semiamplectentia, oblique oblonga, superne paulum dilatata, breviter obtuse acuminata, basi valde obliqua, $^1/_3$ parte mediana valde concava, 1nervia, c. 1.275 cm., tota 1.55 cm. longa, 0.55 cm. lata. Petala sepalo dorsali agglutinata, valde inaequilatera, latere interiore angustissima, oblique oblonga, apicem versus leviter dilatata, deinde triangulo-contracta, subacuta, concava, 1nervia, c. 1.23 cm. longa, 0.44 cm. lata. Labellum calcaratum, trilobum, hypochylio valde concavo, marginibus gynostemio adpresso, oblongo, c. 0.5 cm. longo, lobis lateralibus erectis, brevibus, apice valde involuto late rotundatis, mesochylio (ungue lobi intermedii) marginibus arcte inflexis supra contiguis oblongo, apicem versus angustato, a dorso valde compresso, supra canaliculato, transverse ruguloso, inferne utrinque appendicibus c. 7 abbreviatis obtusis deinde appendicibus c. 8 elongatis inaequilongis filiformibus curvulis instructo, c. 0.4 cm. longo, ad lacinias 1.55 cm. lato, epichylio (lamina lobi intermedii) expanso, bipartito, apiculo recurvo conduplicato acuto in sinu, explanato c. 1.2 cm. lato, lobis oblique late contracto-cuneato-obovatis, late rotundatis, irregulariter marginatis, c. 0.75 cm. longis, 0.625 cm. latis; calcar reversum, ovario fere parallelum, elongatum, vix incurvulum, apice excepto lateraliter compressum, apice manifeste bilobulum, lobulis divergentibus, acuminato-conicis, anguste obtusis, glandulis 2 longitudinalibus oblongis intus infra apicem, c. 1.3 cm. longum, Gynostemium ovarium continuum, dorso convexum, usque ad apicem rostelli c. 0.7 cm. longum, subtus lamellis 2 magnis accumbentibus gynostemio tota longitudine adnatis oblique oblongis superne paulo dilatatis et in lobulum triangulum anguste obtusum exeuntibus postice in lobulum satis angustum oblongum rotundatum productis c. 0.9 cm. longis instructum, clinandrio alte excavato, oblique cucullato. Anthera cucullata, basi in clinandrium immersa, cordata, longe acute acuminata, connectivo convexo-incrassato, postice in lobulos basales producto, c. 0.57 cm. longa. Pollinia 2, valde curvata, oblique clavata, cum caudiculis linearibus et glandula acuta c. 0.66 cm. longa. Rostellum antheram superans, oblongum, apicem versus angustatum, 2dentatum. Stigmata 2, in utroque latere gynostemii ad basin rostelli, parva, oblique suborbicularia, convexa. Ovarium rectum, teres, apicem versus sensim attenuatum, apice valde obliquum, basi brevissime contractum, tortum, 6sulcatum, glanduloso-pilosum, c. 2 cm. longum.

Sumatra: Ophir districts, Goenoeng Talamau. (E. JACOBSON, cutl.

sub n. 760). As quoted, on the north-western slope, 1600 m., in forest, rare. (H. A. B. BÜNNEMEIJER n. 765, May 1917). Goenoeng Malintang, 1800 m., in forest. (H. A. B. BÜNNEMEIJER n. 4036, July 1918). Laras Talang, Goenoeng Talang 1650 m. and 1700 m. (H. A. B. BÜNNEMEIJER nrs. 5350 and 5375, October 1918). Laras Talang, Boekit Gombak, 1700 m., in forest. (H. A. B. BÜNNEMEIJER n. 5445, November 1918). Agam, Boekit Batoe Banting. W. GROENEVELDT, cult. sub n. 1762; a peloric form). Goenoeng Taloek, in forest. (W. ROTHERT, November 1909).

A pretty species resembling *A. setaceus* BL. in the colour of the leaves, but with a much longer spur, broader lobes of the lip, whereas the lamellae of the column have a blunt posterior lobe. From *A. brevilabris* LNDL. it may distinguished after RIDLEY's short description by the colouring of the leaves, the broadly cuneate lobes of the lip and the cordate acuminate glabrous anther.

"Leaves velvety blackish green with light yellow veins, more or less purplish beneath. Stem, bracts and ovary olive-green. Sepals white inside, base and tip outside olive-brown, tip suffused with wine-red. Petals white. Lip white with a light green spur. Column white with the upper margin green. Anther ochreous." (E JACOBSON).

According to Mr. JACOBSON the veins of the leaves are light yellow, whereas Mr. BÜNNEMEIJER describes them as silvery or light green.

Description from herbarium and materials preserved in alcohol.

Cystorchis appendiculata J. J. S. n. sp.

Caulis e basi decumbente radicante c. 17 cm. longa adscendens, teres, parte erecta c. 4 cm. longa, c. 7folia. Folia oblique ovata, obtusa, undulata, 5nervia, c. 3.5—3.7 cm. longa, 2,4—2.2 cm. lata, summum parvum; petiolus brevis, cum vagina brevi c. 0.65—0.85 cm. longus. Inflorescentia erecta, apice dense c. 10flora, pedunculo glanduloso-pubescenti, c. 5.75 cm. longo, vaginis c. 2 tubulosis longe acuminatis donato, rachide c. 1 cm. longa, indumento pedunculi. Bracteae ovario adpressae, concavae, e basi ovato-triangula sensim longe acute acuminatae, inferne fimbriatae, dorso pubescentes, 1nerviae, c. 0.9 cm longae, absque fimbriis 0.4 cm. latae. Flores cum calcari c. 1.15 cm. longi. Sepalum dorsale sigmoideum, e medio fere recurvum, ovato-lanceolatum, apicem versus sensim angustatum, obtusum, concavum, dorso inferne sparse glanduloso-pilosum, superne medio tantum parce pilosum, 1nervium, c. 0.8 cm. longum, 0.25 cm. latum. Sepala lateralia oblique lanceolata, obtusa, basi margine interiore valde rotundato-dilatata vesiculas calcaris amplectentia, concava, indumento sepali dorsalis, 1nervia, nervo 1 brevi addito, fere 0.8 cm., tota 1 cm. longa. Petala sepalo intermedio agglutinata, apice margine interiore arcte conglutinata, inaequilatera, oblique semiovato-lanceolata, sensim angustata, obtusa, basi et latere interiore concava, margine exteriore supra basin dilatatam recurva, latere exteriore intus convexo-incrassata et basi excepta papillosa, 1nervia, c. 0.725

cm. longa, 0.2 cm. lata. Labellum sepala bene superans, calcaratum, gracile, incurvulum, supra visum ambitu lineare, subtrilobum, basi valde excavato-concavum, marginibus incurvis postice in lobulum brevissimum erectum obtusum dilatatis gynostemio adpressum, marginibus ante gynostemium valde incurvis conglutinatis contractum et tubum sectione transversa ovalem a dorso compressum supra canaliculatum superne utrinque calloso-incrassatum formans, apice explanatum et lobulum terminalem reniformem apice late obtusangulum basi utrinque rotundatum concavum subtus convexum carnosulum faciens, callositatibus longitudinalibus parallelis oblique oblongis transverse rugulosis subtus canalicula separatis c. 0.47 cm. longis, 3nervium, absque calcari c. 0.86 cm. longum, inferne (inexplanatum) 0.25 cm. latum, parte callifera fere 0.2 cm. latum, lobulo terminali inexplanato c. 0.1 cm. longo, fere 0.2 cm. lato; calcar reversum, ovario adpressum, medio obtusangule incurvum, utrinque in vesiculam a latere compressam antice liberam porrectam rotundatam subfalcatulam intus glandula globosa donatam auctum, apice breviter obtuse conico-productum, usque apicem vesicularum c. 0.5 cm. longum, 0.35 cm. latum. Gynostemium breve, cum rostello c. 0.43 cm. longum, clinandrio alte cucullato, oblique subtruncato. Anthera alte cucullata, basi in clinandrium immersa, cordata, acuta, lobis basilaribus (thecarum) late bilobulis, connectivo valde umbonato ambitu triangulo, apice tenuiter membranacea, ante connectivum plica /\formi instructa, apice recurvula, c. 0.25 cm. longa. Rostellum antheram superans, canaliculatum, subtus convexum, oblongo-lineare, apicem versus angustatum, 2dentatum. Stigma quadrangulum, marginibus dilatatum, postice in appendicem conspicuam reversam triangulam apice minute et irregulariter lacinulatam concavam dorso convexam in calcar quadrantem cum stigmate ambitu longe ellipticam productum. Ovarium tortum, apice recurvulum, basi brevissime contractum, glanduloso-pilosum, 6sulcatum, c. 0.75 cm. longum.

Sumatra: Agam, Boekit Batoe Banting. (E. JACOBSON, cult. sub n. 1563).

A remarkable species because of the conspicuous triangular appendage of the stigma, not hitherto described in the genus. In the form of the lip it is nearer to *C. variegata* BL. than to *C. javanica* BL., but it is much more slender though not so long as in *C. stenoglossa* SCHLTR.

„Leaves very dark velvety purple above, light purple beneath. Peduncle whitish, the upper half olive brown. Bracts light purple. Ovary light green with brownish green ribs. Sepals base light green, centre watered cinnamon-brown, apical half light saffron. Petals light brimstone-yellow, brownish at the outer margin and at the base. Column white. Pollinia light yellow". (E. JACOBSON).

Description from a specimen preserved in alcohol.

Cystorchis aberrans J. J. S. n. sp.

Caulis e basi decumbente radicante 3.5—6 cm. longa adscendens, teres, parte erecta c. 2.5 cm. longa, c. 5folia. Folia patentia, petiolata, oblique ovata ad ovato-elliptica, apice angustata, acuta, apiculata, basi breviter in petiolum contracta, c. 5nervia, curvinervia, laxe transverse venosa, c. 2—3.5 cm. longa, 1.5—2.2 cm. lata; petiolus cum vagina late tubulosa c. 1.2—1.5 cm. longus. Inflorescentia stricta, apice densius multiflora, pedunculo tereti, pubescenti, c. 23.5—25 c.m longo, vaginulis c. 4 superiore excepta basi tubulosis laxe adpressis acutis ad c. 1.9 cm. longis donato, rachide densius pubescenti, c. 2—3.5 cm. longa, 12—15flora. Bracteae ovario adpressae, e basi dilatata ovata concava ciliata longe subulato-acuminatae, acutae, 1nerviae, c. 0.95 cm. longae. Flores quaquaversi, ovario erecto-patentes, tepalis cum ovario angulum subrectum facientibus, omnino glabri, c. 0.6 cm. lati. Sepalum dorsale horizontale, anguste oblongum, obtusum, concavum, marginibus basi incurvis, 1nervium, c. 0.65 cm. longum, fere 0.2 cm. latum. Sepala lateralia oblique porrecta, divergentia, verticalia, basi basin labelli amplectentia, anguste oblique oblonga, obtusa, concava, 1nervia, bene 0.6 cm., margine antico 0.675 cm. longa, 0.23 cm. lata. Petala sepalo dorsali agglutinata, oblique lanceolata, apice angustato oblique subtruncata, basi subfalcata unguiculato-contracta, inaequilatera, latere sepala lateralia versus spectante latiora, concava, 1nervia, sepalo dorsali paulo breviore, c. 0.6 cm. longa, 0.175 cm. lata. Labellum horizontale, ambitu oblongum, marginibus valde incurvis gynostemio adpressum, valde canaliculato-concavum, apice in laminam satis conspicuam leviter recurvulam gynostemium superantem ambitu orbiculari-ovatam obtusam bene concavam subtus convexam et esulcatam c. 0.12 cm. longam productum, basi rotundato-concavum et utrinque obsolete inflatum cum glandula conspicua porrecta oblique conica curvuia oblique truncato-obtusa, extus callositatibus 2 conspicuis longitudinalibus oblique oblongis irregulariter crenulato-marginatis rugulosis in facie inferiore labelli sulco alto separatis ad basin laminae terminantibus in basi labelli in costam unicam conspicuam convexam esulcatam basin attingentem confluentibus instructum, intus in utraque parte canaliculae conspicuae convexo-incrassatum, totum c. 0.66 cm. longum. Gynostemium cum ovario angulum obtusum faciens, gracile, c. 0.44 cm. longum, clinandrio oblongo, concavo. Anthera rostellum superans, cucullata, anguste cordato-oblonga, apice recurvula obtusa, basi breviter biloba, connectivo convexo-incrassato. Pollinia elongata. Rostellum bifidum, laciniis obtusis. Stigma orbiculari-quinquangulare, margine elevatum recurvumque. Ovarium erectum, sessile, tortum, apicem versus attenuatum, 6sulcatum, glabrum, c. 0.6 cm. longum.

Sumatra: Padangsche Bovenlanden, Laras Talang, Goenoeng Talang, 2000 m., in the forest. (H. A. B. BÜNNEMEIJER n. 5538, November 1918). As quoted, Boekit Gombak, 1800 m., in forest. (H. A. B. BÜNNEMEIJER n. 5706, November 1918).

Though aberrant this plant is, I think, best placed in the genus *Cystorchis*. Habitus and inflorescence are wholly those of a *Cystorchis*, the lip, however, not only lacks a real spur as in *C. aphylla* RIDL. but also the vesicles at the base of the lip, which are present in all species hitherto described, are practically wanting. In other respects viz. the callosities on the sides of the lip, which is also thickened inside, and the apical lamina it agrees with *Cystorchis*. The column and anther are longer than usual.

„Stem light violet; leaves silky green above, violet beneath, flowers white." (BÜNNEMEIJER).

Description from a few dried specimens and part of an inflorescence preserved in alcohol.

Hetaeria rostrata J. J. S. n. sp.

Caulis e basi decumbente radicante c. 20 cm. longa adscendens, crassiusculus, c. 16—20 cm. altus, laxe 5—6folius. Folia oblique ovata ad elliptica, acute acuminata, basi subrotundata ad elliptica, curvinervia, nervis c. 5 majoribus, laxe renticulato-venosa, sicco membranacea, c. 8.5—9.5 cm. longa, 3.5—4 cm. lata; petiolus canaliculatus, cum vagina tubulosa c. 3.7—5.5 cm. longus. Inflorescentia stricta, elongata, laxe multiflora, pedunculo puberulo, c. 15—18.5 cm. longo, vaginulis c. 4 tubulosis acute acuminatis glabris superne in bracteas vergentibus donato, rachide puberula, c. 19 cm. longa. Bracteae ovario adpressae, apice angulato-reflexae, e basi late triangula vel potius quinquangulari longe lineari-acuminatae, acutae, concavae, glabrae, 1nerviae, c. 0.6 cm. longae, 0.37 cm. latae. Flores parvi, non inversi, cum ovario erecto angulum rectum facientes, horizontales, c. 0.5 cm. longi, sepalis petalisque parallelis. Sepalum dorsale late ovatum, acuminatum, obtusum, concavum, dorso inferne parce puberulum, 3nervium, bene 0.4 cm. longum, 0.27 cm. latum. Sepala lateralia oblique subovato-elliptica, obtusa, concava, dorso parce puberula, 3nervia, fere 0.4 cm. longa, 0.26 cm. lata. Petala sepalo dorsali leviter agglutinata, valde undato-sigmoidea, apice libera recurvaque, oblique subspathulato-linearia, apicem versus leviter dilatata, apice brevissime contracta, truncato-obtusa, vix falcatula, 1nervia, c. 0.425 cm. longa, 0.075 cm. lata. Labellum superum, horizontale, valde concavum, ambitu ovale, medio fere leviter constrictum, inferne marginibus erectis incurvulis gynostemio adpressum, c. $^1/_3$ parte superiore ante gynostemium marginibus rectangule dilatatis valde incurvis contiguis et inferne lobulo rotundato tegentibus cucullum conspicuum postice apertum formans, cucullo superne utrinque carnoso-incrassato, umbones 2 crassos obtusos papillosos formante, ante umbones in laminam parvam brevem triangulam trilobulatam tenuem lobulis lateralibus margine incurvam lobulo apicali semiovali rotundato incurvulam productum, subtus convexum cum sulco longitudinali, 3nervium, nervis basi furcatis, callis 2 lamelliformibus in ramulo interiore nervorum exteriorum sitis horizontalibus transversis medium versus spectantibus lineari-oblongis apice laciniatis et contiguis

intus in $^1/_3$ parte supra basin, inexplanatum c. 0.35 cm. longum, 0.2 cm. latum, lamina apicali c. 0.025 cm. longa. Gynostemium reversum, cum ovario angulum acutum faciens, dorso ovario fere parallelum, basi attenuatum, subtus inferne leviter concavum, superne lamellis 2 porrectis parallelis cum gynostemio angulum obtusum cum rostello angulum acutum facientibus a latere visis triangulis vel margine antico rotundato-subquadrangulis satis acutis papillosis carnosulis rostello bene brevioribus instructum, fere 0.3 cm. longum, clinandrio alte excavato, membranaceo. Anthera cucullata, basi in clinandrium immersa, cordata, longe acute acuminata, connectivo basi 3lobulato. Rostellum porrectum, antheram paulum superans, oblongum, carnosulum, bipartitum, laciniis lanceolato-linearibus. Stigmata 2, in utroque latere gynostemii ad basin rostelli, calliformia, sulco transverso instructa. Ovarium erectum, fusiforme, rostratum, 3costatum, 6sulcatum, breviter hirtello-papillosum, facie bractea obtecta subglabrum, totum c. 0.55 cm. longum, rostro bene 0.1 cm. longo.

Sumatra: West coast, Goenoeng Sago, 1600 m., in forest. (H. A. B. BÜNNEMEIJER n. 4361, August 1918). Palembang, Goenoeng Dempoe, Air Njoeroek. (Expedition E. JACOBSON, AJOEB n. 414, August 1916).

An ally of *H. oblongifolia* BL. but with larger flowers and very different petals, lip and column.

„Flowers green and white," (BÜNNEMEIJER).

Description from herbarium and part of an inflorescence preserved in alcohol.

Goodyera Gibbsiae J. J. S. nom. nov. — *G. arfakensis* J. J. S. in GIBBS, Contrib. Phyt. Fl. D. N. W. N. Guinea (1917), 108.

As the name was preoccupied it should be changed.

Tainia (sect. Mischobulbum) **sumatrana** J. J. S. n. sp.

Rhizoma longe repens, ramosum, fibris vaginarum mox fatiscentium tectum, radicibus paucis. Pseudobulbi c. 2.7—3.3 cm. dissiti, sicco petioliformes, tenues, c. 7.5—8 cm. longi, 1folii. Folium sessile, cordatum, acute acuminatum, lobis basilaribus rotundatis, curvinervium, nervis 5 conspicuis numerosis tenuibus, subtus minute punctatum, c. 11 cm., cum lobis basilaribus 11.75 cm. longum, 5.4—6.4 cm. latum. Inflorescentia erecta, laxe pauciflora, pedunculo c. 18 cm. longo, nonnullis vaginulis tubulosis punctatis ad c. 4 cm. longis donato, rachide c. 4.5 cm. longa. Bracteae lineari-triangulae, acutae, ad c. 1—2 cm. longae, superiores minores. Flores c. 4, majusculi, c. 3.2 cm. longi. Sepalum dorsale porrectum, cum ovario angulum obtusum faciens, apice leviter obtusangule recurvum, lanceolatum, superne leviter contractum, acuminatum, acutum, apice canaliculatum, 5nervium, costa media et nervis 2 sequentibus ad basin dorso obtuse prominentibus, c. 2.1 cm. longum, 0.53 cm. latum. Sepala lateralia ad pedem gynostemii decurrentia, divergentia, oblique lineari-lanceolata, sensim acuminata, acutissima, basi antice triangulo-dilatata, apice canaliculata, 5nervia, nervis praesertim intermedio dorso

prominentibus, c. 2.4 cm., longa, basi 1.15 cm., supra basin 0.5 cm. lata. Petala oblique porrecta, paulum in pedem gynostemii decurrentia, oblique ovata, acuminata, acuta, c. 5(—7)nervia, costa media intus sulcata dorso bene prominente, fere 2 cm. longa, 0.86 cm. lata. Labellum erectum, paulum infra medium valde recurvum, leviter 3lobum, concavum, costis 3 aliformibus basi humilibus superne leviter undulatis, intermedia usque infra apicem producta, exterioribus brevioribus bene altioribus in lobo medio intermediam aequantibus, subtus costa longitudinali conspicue prominente apicem versus decrescente instructum, inexplanatum c. 1.85 cm. longum, explanatum ambitu late rhombeum, basi contractum truncatumque, 5nervium, nervis exterioribus bene ramosis, c. 2.4 cm. longum, 1.85 cm. latum; lobi laterales erecti, incurvuli, oblique rotundati, antice angulati; lobus intermedius plica rotundata introrsa a lobis lateralibus sejunctus, marginibus incurvis concavus, ovato-triangulus, breviter acuminatus, acutus, c. 0.65 cm. longus, 0.8 cm. latus. Gynostemium rectum, dorso convexum, subtus concavum, absque anthera c. 0.93 cm. longum, clinandrio concavo, pariete postico producto rotundato repando, auriculis brevibus, rotundatis, denticulatis. Rostellum patentissimum, triangulum, convexum cum costula longitudinali obtusa. Pes gynostemii cum ovario et gynostemio angulos rectos faciens, rectus, late linearis, apice paulo dilatatus et labelli basi lata adnatus, concavus, c. 1.25 cm. longus. Ovarium latiuscule 6sulcatum, subverruculosum, minute furfuraceo-punctatum, c. 0.85 cm. longum; pedicellus tenuior, bene 0.7 cm. longus.

Sumatra: Bataklanden, North Delok Sebajak, 1650 m., terrestrial in forest. (J. A. LÖRZING n. 7312, June 1920).

Padangsche Bovenlanden, Goenoeng Malintang, 1500 m., terrestrial in forest. (H. A. B. BÜNNEMEIJER n. 4043, July 1918).

The nearest ally appears to be *T. cordifolia* HOOK. F. from Formosa.

„Leaves bright green with dark green parts especially along the nerves, with a peculiar bluish green shine, somewhat lighter green beneath. Flowers in general winered, yellow with purple dots at the base. Lip pale crimson outside, yellowish dotted bright crimson inside with a yellow band within the dark brown dotted margins, top of lip more wine red. Column pale yellow dotted bright crimson". (LÖRZING).

„Sepals green, streaked violet. Lip with violet dots and a yellow apex. Stem green tinged violet. Bracts green". (BÜNNEMEIJER).

Description from LÖRZING n. 7312, which consists of a dried specimen and a flower preserved in alcohol.

Tainia (sect. Mitopetalum) **tenera** J. J. S. n. sp.

Rhizoma repens, radicibus crassis pubescentibus. Pseudobulbi c. 2—3 cm. dissiti, elongati, sicco tenues, c. 2.5—2.75 cm. longi. Folium erectum, petiolatum, lanceolatum, sensim acutatum, basi obtusum, nervis 3 conspicuis

et pluribus tenuibus, sicco papyraceum, c. 6.75—8 cm. longum, 1.4—1.9 cm. latum; petiolus superne canaliculatus, c. 2 3.3 cm. longus. Inflorescentia membrum separatum sympodii, erecta, elongata, laxe pluriflora, pedunculo c. 29 cm. longo, vaginulis c. 3 longis tubulosis donato, vaginula ultima longissima ad c. 5 cm. longa, rachide 5.5 cm. superante. Bracteae patentes, lineari-triangulae, acutissimae, concavae, ad c. 1.3 cm. longae. Flores c. 9, sepalis petalisque conniventibus c. 1.2 cm. longi. Sepalum dorsale cum ovario angulum obtusum faciens, incurvulum, lineare, subacutum, concavum, 3nervium, nervis exterioribus brevibus, c. 1.25 cm. longum, 0.15 cm. latum. Sepala lateralia pedi gynostemii inserti, falcato-linearia, acuta, concava, nervis sepali dorsalis, c. 1.25 cm. longa, fere 0.2 cm. lata. Petala falcato-linearia, apice angustata, concava, nervis sepalorum, c. 1.25 cm. longa, fere 0.2 cm. lata. Labellum gynostemio parallelum, recurvulum, 3lobum, concavum, subtus convexum, infra basin lobi intermedii leviter ventricosum, costis 3 simplicibus rectis, intermedia humiliore apicem labelli non attingente, exterioribus supra basin lobi intermedii evanescentibus, c. 1.1 cm. longum, explanatum ambitu oblongum, fere c. 2 cm., usque apicem loborum lateralium 0.85 cm. longum, 0.65 cm. latum; lobi laterales longe adnati, parte libera porrecti, verticales, trianguli, falcatuli, acuti; lobus intermedius porrectus, ovatus, obtusus, triangulo-apiculatus, basi breviter et leviter contractus, concavus, c. 0.48 cm. longus, 0.425 cm., basi 0.375 cm. latus. Gynostemium cum ovario angulum obtusum faciens, gracile, arcuatum, leviter clavatum, subtus costulis 2 parallelis convexis instructum et apicem versus concavum, c. 0.7 cm. longum, clinandrio alte excavato, margine repandulo. Anthera cucullata, ambitu rotundato-quadrangula, basi rotundato-bilobula, apice paulo dilatata, obtusissima, costula longitudinali prominula brevissime apiculata, costula brevi convexa utrinque in medio, c. 0.17 cm. lata. Pollinia 8. Rostellum distinctum, semiorbiculare. Stigma triangulum, basi dilatatum, margine inferiore elevato truncato emarginato. Pes gynostemii cum ovario angulum rectum, cum gynostemio angulum obtusum faciens, rectus, quadratus, truncatus, concavus, marginibus erectis apice rotundatis, c. 0.17 cm. longus. Ovarium teres, 6sulcatum, c. 0.35 cm. longum; pedicellus tenuior, c. 0.4 cm. longus.

Sumatra: Benkoelen, Rimbo Pengadang. (Exp. E. JACOBSON, AJOEB n. 198, June 1916).

A small inconspicuous species in the shape of the flower resembling *T. latifolia* BTH. from India.

The flowers are described as green red with a light yellow lip.

Description from a small dried specimen without flowers and the upper portions of two inflorescences preserved in alcohol.

Coelogyne malintangensis J. J. S. n. sp.

Rhizoma validum, elongatum, ramosum, cylindricum, sicco ad c. 0.5 cm. diam., initio vaginis imbricantibus basi tubulosis tectum, internodiis ad

c. 1.6 cm. longis, radicibus crassis. Pseudobulbi c. 6—7 cm. dissiti, sicco subcylindrici, crassitudine rhizomatis, c. 3.4—5.7 cm. longi, diphylli, initio vaginis imbricantibus sursum accrescentibus ad c. 3.5 cm. longis tecti. Folia internodio c. 0.25—0.4 cm. longo sejuncta, erecta, divergentia, elliptica ad lanceolato-elliptica, leviter acuminata, acuta, basi in petiolum angustata, undulata, nervis c. 5—7 majoribus et pluribus tenuioribus sicco subtus prominentibus, c. 5.75—11.5 cm. longa, 2.1—3.6 cm. lata; petioli adpressi, canaliculati, c. 0.6—1.3 cm. longi. Inflorescentia in pseudobulbis novellis sed fere maturis, erecta, brevis, laxe c. 4—6flora, pedunculo nudo, apicem versus sensim leviter incrassato, c. 4.7—10 cm. longo, rachide flexuosa, c. 2—5.5 cm. longa, internodiis latere florem versus spectante applanatis c. 0.8—1 cm. longis. Bracteae caducae, initio apicem rachidis amplectentes, ovato-ellipticae, acutae, apiculatae, intus muricibus minimis adspersae, c. 9—10nerviae, c. 2.7 cm. longae, 1.1 cm. latae vel majores. Flores mediocres, simultanee explanati. Sepalum dorsale incurvum, apice plus minusve recurvum, concavum, superne convexum cum canalicula, ambitu ovatum, e basi subovali sensim longe triangulo-acuminatum, acutum, basi vix contracta intus muricibus minimis parce inspersum, 5nervium, fere 2.6 cm. longum, 1 cm. latum. Sepala lateralia obtusangule canaliculata cum lateribus convexis, apice recurva, oblique ovato-lanceolata, sensim acutata, acuta, apiculata, basi leviter contracta, intus muricibus minimis parce inspersa, dorso carinata, 5nervia, c. 2.5 cm. longa, 0.7 cm. lata. Petala oblique sublinearia, apicem versus sensim angustata, acuta, intus convexa et muricibus minimis parce inspersa, dorso sulcata, 3nervia, c. 2.7 cm. longa, 0.26 cm. lata. Labellum subsimplex, basi gynostemio parallelum, deinde recurvum, undatum, apice recurvum, basi lateribus erectis rotundatis intus convexis extus concavis concavum, ceterum convexum cum fascia mediana elevata, apice recurvo canaliculatum, costis 3 simplicibus convexis laevibus in flexu supra basin incrassatis fere usque apicem productis, glabrum, explanatum c. 2.1 cm. longum, e hypochylio paulo contracto transverse subovali in lobum intermedium magnum ovatum acute subulato-acuminatum 7nervium c. 1.4 cm. longum 0.9 cm. latum productum. Gynostemium gracile, superne arcuatum et anguste alatum, trigonum, apice truncato subtrilobum, c. 0.9 cm. longum, clinandrio concavo, pede distincto, cum gynostemio et ovario angulum obtusum faciente, obtusangule incurvo, quadrangulo, concavo. Anthera non abscondita, cucullata, supra visa ambitu suborbicularis, apice truncata et recurvula, basi biloba, connectivo basi obtuse conico-gibboso, c. 0.175 cm. lata. Pollinia 4, oblique ovalia, extus convexa, intus plana vel leviter concava. Rostellum late rotundatum, convexum. Stigma margine inferiore elevatum, recurvum, rotundatum. Ovarium breve, obconicum, valde 6costatum, glabrum, c. 0.4 cm. longum; pedicellus teres, bene 1 cm. longus.

Sumatra: West coast, Goenoeng Malintang, 1700—2200 m., in forest and brushwood. (H. A. B. BÜNNEMEIJER nrs. 4050, 4216 and

4220, July—August 1918). Bataklanden, Toba, 1400 m. (O. HAGERUP n. 14, 1916—'17).

Though totally different in habit this much resembles *C. vermicularis* J. J. S. from Borneo in the characteristics of the flowers.

The flowers of n. 4050 are described by the collector as yellowish green, those of nrs. 4216 and 4220 as flesh-coloured.

In the specimens collected bij Mr. HAGERUP the sepals are not acuminate. Perhaps they may be regarded as a variety.

Description from herbarium and flowers preserved in alcohol.

Coelogyne Buennemeyeri J. J. S. n. sp.

Rhizoma breve, validum, ramosum, teres, vaginis coriaceis, radicibus crassis. Pseudobulbi approximati, c. 1—2 cm. dissiti, oblongo-conici, c. 6—7.5 cm. longi, diphylli, initio vaginis imbricantibus sursum accrescentibus ovatis obtusis ad c. 6—9.5 cm. longis tecti. Folia erecta, divergentia, petiolata, lanceolata, acuminata, acuta, basi acuta, costa media sicco supra subtusque prominente, plerumque nervis 2 majoribus et pluribus minoribus in sicco prominulis utrinque, coriacea, supra nitida, subtus subopaca, c. 18 – 26 cm. longa, 2.6—4.5 cm. lata; petiolus canaliculatus, c. 3—7 cm. longus. Inflorescentia proterantha, erecta, arcuata, laxe multiflora, pedunculo c. 5—8.5 cm. longo, rachide c. 20—36 cm. longa. Bracteae conspicuae, persistentes, ovario pedicellato breviores, ovato-orbiculares, rotundatae, valde concavae cum marginibus involutis, multinerviae, ad c. 1.75 cm. longae, superiores decrescentes, 1—2 inferiores saepe steriles et rachidem amplectentes. Flores c. 20—25, mediocres. Sepalum dorsale ovato-oblongum, apicem versus angustatum, obtusum, obtusangule concavum cum lateribus convexis et marginibus recurvulis, basi concavum, dorso obtusangule convexum, 5nervium, costa media dorso prominente, c. 2.45 cm. longum, fere 1 cm. latum. Sepala lateralia oblique subovato-oblonga, apicem versus angustata, anguste obtusa, apiculata, obtusangule canaliculata cum lateribus valde convexis et marginibus recurvulis, dorso carinata, 5nervia, c. 2.4 cm. longa, 0.85 cm. lata. Petala oblique linearia, apice angustata, subacuta, convexa, 3nervia, costa media dorso sulco costulis manginato instructa, c. 2.37 cm. longa, 0.3 cm. lata. Labellum leviter recurvum, 3lobum, valde concavum, carinis 2 simplicibus irregulariter crenatis supra basin in $^2/_3$ partibus supra basin lobi intermedii abrupte terminantibus, inter carinas obtusangule canaliculatum, subtus manifeste carinatum, explanatum ambitu ovatum, c. 2.3 cm., usque apicem loborum lateralium c. 1.6 cm. longum, 1.73 cm. latum; lobi laterales semiovati, apice libero brevi oblique rotundato denticulato-crenulati, concavi; lobus intermedius porrectus, orbiculari-sexangulatus, apice subtruncatus, vix retusus, erosulus, concavus, c. 0.95 cm. longus, fere 1.1 cm. latus. Gynostemium curvatum, basi anguste dimidio superiore late alatum et subtus concavum, ala apicali recurvula truncata dentata, c. 1.7 cm.

longum. Anthera sub ala abscondita, cucullata, suborbicularis, apice late rotundata recurvulaque, connectivo basi crasse obtuse conico-gibboso, c. 0.25 cm. lata. Pollinia 4, paulo inaequalia, a dorso compressa, oblique subobovato-ovalia, extus convexa, majora intus leviter concava. Rostellum magnum, late sexangulatum, obtusissimum. Stigma margine inferiore elevatum recurvum obtusangulum. Ovarium obconicum, 6sulcatum, furfuraceum, c. 0.6 cm. longum; pedicellus superne parce furfuraceus, c. 1.4 cm. longus.

Sumatra: Padangsche Bovenlanden, Goenoeng Talang, 2350 m., underbrush between cliffs. (H. A. B. BÜNNEMEIJER n. 5225, October 1918). Ut supra, 2950 m., on trees in forest. (H. A. B BÜNNEMEIJER n. 5376, November 1918). Ut supra, 2500 m., underbrush between cliffs. (H. A. B. BÜNNEMEIJER n. 5500, November 1918).

This seems to be placed best in PFITZER's group *Glumaceae*, though the sterile bracts at the base of the rachis are not always present. There are only two crenate keels.

The flowers are said to be light rose-salmon-coloured, rarely with a greenish tint.

Description from herbarium and flowers preserved in alcohol.

Gynoglottis cymbidioides J. J. S. in Rec. trav. bot. néerl. I (1904), 49, t. II; PFITZ. et KRZL. in Pflanzenr. Heft 32 (1907), 131. — *Coelogyne cymbidioides* RCHB. F. in WALP. Ann. VI (1861), 239. — *C. xyloboides* KRZL. in ENGL. Bot. Jahrb. XVII (1893), 482.

Pseudobulbi ad c. 9 cm. longi, vaginis ad basin ad c. 15 cm. longis. Folia ad c. 65 cm. longa, 4.7 cm. lata, petiolo c. 5 cm. longo. Pedunculus teres, dilute viridis, nitidus, ad c. 19 cm. longus; rachis angulata, dilutius viridis, nitida, ad c. 15 cm. longa. Flores patentissimi, valde odorati, sepalis petalisque albis. Labelli unguis sulphureus; lobi laterales cinnamomeo-aurantiaci, margine angusto flavescenti-albi, undulati; lobus intermedius disco triangulo cinnamomeo-aurantiacus, superne sulphureus, lateribus albus, flavescenti-suffusus, apicem versus albus. Gynostemium album. Ovarium 6sulcatum, dilute viride; pedicellus albus.

Sumatra: Padangsche Bovenlanden, Laras Talang, Boekit Gombak, 1830 and 1900 m., in forest, common. (H. A. B. BÜNNEMEIJER nrs. 5458 and 5701, November 1918; cult. in Hort. Tjibodas).

Additional notes from abundant material collected by Mr. BÜNNEMEIJER and from living specimens collected by the said gentleman and cultivated in the mountain garden Tjibodas.

Dendrochilum (sect. Eudendrochilum) **alboviride** J. J. S. n. sp.

Rhizoma elongatum, ramosum, teres, dilute flavo-viride, 0.3—0.4 cm. diam., initio vaginis tubulosis tectum, internodiis c. 2.2 cm. et plus longis.

Pseudobulbi c. 3—7 cm. dissiti, cum rhizomate angulum acutum facientes, oblongo-fusiformes, nitide flavo-virides, c. 1.5—3 cm longi, 0.5—0.85 cm. diam. Folium lanceolatum, acutum ad obtusum, apiculatum, basi angustatum, costa media supra sulcata, tenuiter coriaceum, nitide dilute viride, subtus opacum, c. 9.5—11 cm. longum, 1.5—2.25 cm. latum. Inflorescentiae heteranthae, multiflorae, nonnullis vaginulis imbricantibus obtusis prominenter nervosis pallide virescentibus ad basin, pedunculo c. 0.8—1.1 cm. longo, rachide quadrangula, pallide virescenti, parce papillosa, c. 6—9.5 cm. longa, internodiis c. 0.175—0.2 cm. longis. Bracteae brevissimae, adpressae, vix semiorbiculares, apiculatae, marginibus vix in rachidem decurrentes, concavae. Flores odorati, flavescenti-albi, c. 0.4 cm. lati. Sepalum dorsale erectum, superne incurvulum, oblongum, obtusum, c. 0.34—0.37 cm. longum, bene 0.1 cm. latum. Sepala lateralia divergentia, supra basin recurvula, oblique oblonga, subfalcatula, obtusiuscula, minute apiculata, convexa, c. 0.275—0.325 cm. longa, 0.1—0.12 cm. lata. Petala basi parallela gynostemio erecta, incurva, divergentia, spathulata, falcata, ima basi vix dilatata, c. 0.26—0.3 cm. longa, superne 0.075 cm. lata. Labellum recurvum, panduratum, obtusum, basi truncatum, basi marginibus valde recurvis subtus concavum, ceterum subtus convexum, costis 2 satis altis obtusis infra apicem evanescentibus canalicula obtusangula separatis, costula tertia humili brevi in canalicula, $^3/_5$ partibus inferioribus papillosum et pallide viride, parte antica flavescens, c. 0.17 cm. longum, fere 0.1 cm. latum, infra apicem haud vel vix angustius. Gynostemium supra basin obtusangule incurvum, dorso convexum, pallide viride, alis apicem versus albidum, c. 0.14—0.16 cm. longum, alis lateralibus fere e medio totius gynostemii, porrectis, falcato-linearibus, ala apicali brevioribus, ala apicali obtusangule incurva, undata, oblongo-triangula, acutiuscula, basi utrinque dente obtuso instructa, concava, pede brevi, truncato. Anthera cucullata, transverse subovalis, apice truncata, basi bilobula, dilute viridis, margine albida, c. 0.03 cm. lata, connectivo vix gibboso. Pollinia 4, breviter obovoidea, flava. Rostellum triangulum. Stigma suborbiculare. Ovarium dilute viride, cum pedicello aequicrasso albido c. 0.27 cm. longum.

Sumatra: Palembang, Goenoeng Dempoe. (Exp. E. JACOBSON, AJOEB n. 543, September 1916; also liv. pl. cult. in Hort. Bog. sub n. 59).

Differing from *D. panduratum* SCHLTR. in the broader leaves, semiorbicular apiculate bracts and the lip not broadened towards the apex, and from *D. album* RIDL. in the sessile leaves and the much longer spikes.

Description from a cultivated plant and from portions of the plant preserved in alcohol.

Dendrochilum (sect. Eudendrochilum) **korintjiense** J. J. S. n. sp.

Rhizoma elongatum, verisimiliter patens, valde ramosum, teres, radicans, internodiis ad c. 1.7 cm. longis superioribus decrescentibus, vaginis punctatis

ad c. 1.7 cm. longis parte superiore mox fatiscentibus. Pseudobulbi ad c. 6 cm. distantes, cum rhizomate angulum acutum facientes, sicco rarissime laeves et oblongo-ovales, plerumque rugosi, sicco nitide flavi, ad c. 2 cm. longi. Folium anguste lanceolatum, acutiusculum, subpungens (sicco), basi sensim subpetiolato-angustatum, nervis majoribus c. 5 pluribusque tenuibus sicco supra subtusque prominentibus, rigidulum, tenuiter coriaceum, supra nitidulum, subtus opacum, c. 3.75—7 cm. longum, 0.5 – 0.9 cm. latum. Inflorescentiae in pseudobulbis rudimentariis e rhizomate infra innovationes, solitariae, basi pluribus vaginis alternatim bifariis imbricantibus adpressis acutis superioribus accrescentibus tectae, multiflorae, c. 10—13.5 cm. longae, rachide recta, compresso-quadrangula, lateribus angustis canaliculata, minute muriculato-puberula, c. 8—11.5 cm. longa, internodiis c. 0,2 cm. longis. Bracteae adpressae, late quinquangulares, obtusangulae, concavae, ovario pedicellato breviores, c. 0.14 cm. longae, 0.18 cm. latae. Flores parvi, patentissimi. Sepalum dorsale canaliculato-concavum cum lateribus leviter convexis, incurvulum, apice vix recurvulum, anguste oblongum, supra basin leviter dilatatam leviter constrictum, $^2/_3$ partibus superioribus leviter contractum cum marginibus parallelis, breviter acutatum, 3nervium, c. 0.38 cm. longum, 0.12 cm. latum. Sepala lateralia patentissima, obtusangule canaliculata cum lateribus praesertim inferne convexis, anguste oblique oblonga, brevissime oblique subacuta, 3nervia, costa media dorso prominente, c. 0.375 cm. longa, 0.13 cm. lata. Petala basi gynostemio parallela, deinde recurva, leviter obtusangule canaliculata cum lateribus leviter convexis, e basi vix dilatata falcata oblique lanceolato-spathulata, acuta, 1nervia, c. 0.35 cm. longa, 0.08 cm., basi 0.05 cm. lata. Labellum elastice affixum, parvum, supra basin et apice recurvum, oblongum, econstrictum, explanatum superne leviter contractum, obtusum, superne canaliculato-concavum subtusque convexum, basi subtus concavum, costis 2 parallelis longitudinalibus crassis antice sensim decrescentibus ultra medium evanescentibus, 3nervium, explanatum c. 0.2 cm. longum, fere 0.1 cm. latum. Gynostemium curvulum, dorso convexum, c. 0.175 cm. longum, alis lateralibus supra basin ortis, porrectis, oblique lineari-subulatis, alam apicalem concavam apice recurvulam triangulam apice breviter bidentatam aequantibus vel vix superantibus, pede abbreviato. Anthera abscondita, cucullata, leviter a dorso compressa, apice obtusangula, connectivo abrupte gibboso, c. 0.04 cm. lata. Pollinia 4, breviter oblique obovata. Rostellum patentissimum, triangulum, acutum, leviter convexum. Stigma subquadrangulum, margine inferiore elevato et plus minusve tridenticulato. Ovarium 6sulcatum, c. 0.08 cm. longum; pedicellus 0.2 cm. longus.

Sumatra: West coast, Korintji Peak, 1800 m., in forest. (H. A. B. BÜNNEMEIJER No. 9697, April 1920).

In the narrow leaves this new species resembles more or less *D. pandu-*

ratum SCHLTR., *D. Gravenhorstii* J. J. S., *D. taeniophyllum* J. J. S. and *D. angustifolium* RIDL.

From *D. panduratum* SCHLTR. it differs by the longer pedicels conspicuously surpassing the bracts, the lip not being constricted in the middle, the stelidia at least equalling the clinandrium; from *D. Gravenhorstii* J. J. S. in the more acute leaves, the form of the petals, a very different lip, blunt anther; from *D. taeniophyllum* J. J. S., which is a smaller plant, by the broader leaves, differently coloured flowers, the form of sepals, petals and lip and the much longer pedicel; from *D. angustifolium* RIDL. by the solitary scapes, the lip not being narrow lanceolate, the shortly bidentate top wing of the column and the stelidia arising from above the base of it.

The pseudobulbs are described as orange red, the flowers as light green. In the herbarium the pseudobulbs are distinctly yellow. The branches collected have a length of about 35 cm.

Description from herbarium and part of an inflorescence preserved in alcohol.

Dendrochilum (sect. Eudendrochilum) **complectens** J. J. S. n. sp.

Rhizoma validum, valde dichotome ramosum, verisimiliter basi tantum radicans, teres, sicco flavo-brunneum et bene 0.4 cm. diam., pars adest c. 50 cm. longa, internodiis ad c. 2.4 cm. longis. Pseudobulbi ad c. 9 cm. distantes, superiores magis approximati, rhizoma continui, cum rhizomate angulum acutum facientes, basi excavata rhizoma semiamplectentes, sicco ad c. 4.7 cm. longi. Folium petiolatum, lanceolatum, apice sicco canaliculato-acutum, basi acuta abrupte in petiolum contractum, nervis 7 majoribus sicco supra subtusque et pluribus tenuibus praesertim supra prominentibus, coriaceum, ad c. 9.5 cm. longum, 2.85 cm. latum; petiolus canaliculatus, ad 1 cm. longus. Inflorescentiae e nodis rhizomatis, solitariae, laxe multiflorae, pedunculo vaginulis pluribus imbricantibus acutis atrofusce punctatis tecto, rachide subrecta, quadrangula, haud vel vix compressa, faciebus 2 vix sulcata, densius muriculato-pubescenti, c. 8—10 cm. longa, internodiis c. 0.3 cm. longis. Bracteae adpressae, pedicello breviores, concavae, ambitu bene semiorbiculares, abrupte acute acuminatae, marginibus breviter in rachidem decurrentes, dorso sparse muriculato-pilosae, c. 0.25 cm. longae, 0.275 cm. latae. Flores patentissimi, c. 0.85 cm. lati, sepalis petalisque intus extusque parcissime muriculato-puberulis. Sepalum dorsale medio incurvum, apice recurvulum, canaliculatum cum lateribus convexis, oblongum, apice brevissime acute acuminatum, basi leviter contractum, 3nervium, c. 0.53 cm. longum, 0.175 cm. latum. Sepala lateralia subdivaricata, vix incurvula, obtusangule canaliculata cum lateribus convexis, oblique ovato-oblonga, acuta, apiculata, 3nervia, fere 0.5 cm. longa, 0.2 cm. lata. Petala basi gynostemio adpressa undata, apice recurva, canaliculata cum lateribus leviter convexis, oblique lanceolata, acuta, basi falcatula unguiculato-contracta ima basi paulo dilatata, 3nervia, c. 0.45 cm. longa, 0.14 cm. lata. Labellum parvum, elastice affixum,

basi gynostemio adpressum, supra medium valde abrupte contractum, 3nervium, totum 0.24 cm. longum, hypochylio carnoso, ambitu transverse quadrangulo, margine tenui et minutissime erosulo-papilloso, basi truncato, costis 2 remotis conspicuis basi altis antice decrescentibus et evanescentibus sectione transversa triangulis donato, subtus basi concavo deinde convexo-incrassato cum sulco longitudinali inconspicuo, c. 0.14 cm. longo, 0.15 cm. lato, epichylio angusto, oblongo, apice recurvulo obtuso, tenui, 1nervio, c. 0.1 cm. longo, 0.06 cm. lato. Gynostemium curvatum, c. 0.26 cm. longum, ala apicali triangulo, concavo, apice recurvulo minute 2dentato, alis lateralibus paulum infra medium ortis, porrectis, cum gynostemio angulum acutum facientibus, oblique lineari-subulatis, ala apicali brevioribus, pede distincto, brevi, truncato. Anthera abscondita, cucullata, transverse ovali-reniformis, obtusissima, connectivo gibboso, c. 0.07 cm. lata. Pollinia 4, brevia, obovata. Rostellum triangulum, acutum, recurvulum. Stigma margine inferiore elevatum recurvumque. Ovarium 6sulcatum, vix 0.1 cm. longum, cum pedicello 0.275 cm. longo sigmoideum.

Sumatra: West coast, Korintji Peak, 1400 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 8642, March 1920).

A very distinct species with the lip from a broad base abruptly contracted into a narrow oblong epichyl.

Only the upper part of a stem has been collected. The flowers are said to be light green.

Description from herbarium and an inflorescence preserved in alcohol.

Dendrochilum (sect. Monochlamys) **acuminatum** J. J. S. in Rec. trav. bot. néerl. 1.

var. **laxum** J. J. S. n. var.

Rhizoma elongatum, ramosum, teres, etiam superne radicans, vaginis tubulosis dense nervosis leviter punctatis inferioribus obtusis et internodiis brevioribus superioribus accrescentibus acutis ad c. 2.8 cm. longis tectum, internodiis ad c. 2.2 cm. longis. Pseudobulbi c. 4—6.5 cm. dissiti, rhizoma continui, cum ramis angulum acutum facientes, sicco teretes, tenues, c. 1.2—2 cm. longi. Folium subovato-lanceolatum, longe infra apicem contractum et sensim angustatum, obtusum, breviter apiculatum, basi satis abrupte in petiolum angustatum, nervis c. 7 majoribus subtus prominentibus, sicco rigidiuscule papyraceum, ad c. 8.5 cm. longum, 1.8 cm. latum; petiolus canaliculatus, c. 0.6 cm. longus. Inflorescentia in pseudobulbo immaturo, folio fere evoluto synantha, elongata, nutans, laxe multiflora, pedunculo filiformi, c. 4.25—5.5 cm. longo, rachide lateraliter compresso-quadrangula, lateribus angustis canaliculata, c. 17—22 cm. longa, internodiis c. 0.275—0.3 cm. longis. Bracteae pedicellum amplectentes, late semiorbiculari-triangulae, obtusissimae, interdum brevissime apiculatae, basi breviter contractae,

c. 0.225 cm. longae, 0.275 cm. latae, infima adpressa, sterilis. Flores patentissimi. Sepalum dorsale lanceolatum, acutum, 1nervium, c. 0.47 cm. longum, 0.125 cm. latum. Sepala lateralia oblique lanceolata, apicem versus angustata et canaliculata, acuta, 1nervia, dorso carinata, c. 0.43 cm. longa, 0.125 cm. lata. Petala oblique lanceolata, sensim acuminata, acuta, 1- sub2nervia, concava, c. 0.4 cm. longa, 0.125 cm. lata. Labellum porrectum, rectum vel curvulum, concavum, 3nervium, basi lata medio tantum affixum, callis 2 brevibus longitudinalibus parallelis lateraliter compressis quadrangulis in hypochylio, explanatum ambitu quinquangulari-rhombeum, c. 0.3 cm. longum, hypochylio plus minusve contracto, transverse subquadrangulo, c. 0.075 cm. longo, 0.14 cm. lato, lobo intermedio ovato-quinquangulari, acute acuminato, superne apice excepto papilloso, c. 0.225 cm. longo, 0.17 cm. lato. Gynostemium breve, dorso convexum, c. 0.1 cm. longum, alis lateralibus e parte inferiore, porrectis, falcatulis, oblique linearibus, acutis, alam apicalem ambitu transverse quadrangulam apice tridentatam (an semper?) bene superantibus. Anthera cucullata, transversa, subsemiorbicularis, apice late rotundata et leviter emarginata, c. 0.03 cm. lata, connectivo longitudinali, convexo-incrassato, thecis convexis, lobulis basilāribus majusculis. Pollinia 4, pyriformia. Rostellum semiellipticum, apice canaliculato recurvum. Stigma suborbiculare, margine elevatum. Ovarium obconicum, fere 0.1 cm. longum; pedicellus tenuior, 0.1 cm. longus.

Sumatra: Padangsche Bovenlanden, Laras Talang, Boekit Niroe, 1600 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER No. 5579, November 1918).

At first sight this differs from the type in the longer and laxer inflorescences and larger flowers. It is, however, to be noted, that *D. acuminatum* was described from a cultivated plant, which did not grow very well in Buitenzorg.

The bracts of the two plants are very different; in *D. acuminatum* they are manifestly acuminate, in the variety not at all.

Only the upper parts of the branches were collected.

The flowers are said to be light green.

Description from herbarium material.

Dendrochilum (sect. Monochlamys) **longicaule** J. J. S. n. sp.

Rhizoma elongatum, dependens, valde ramosum, basi tantum radices crassas emittens, c. 1.15 m. longum, internodiis c. 4.5—1.5 cm. longis, vaginis diu persistentibus, dense nervosis, epunctatis. Pseudobulbi ad c. 12 cm. distantes, rhizoma continui, sicco tenues, teretes, inferne semiteretes et facie rhizoma versus spectante canaliculati, rhizomatis crassitudinem vix aequantes, c. 3.4—2.7 cm. longi. Folium petiolatum, lanceolatum, apice longitudine c. 0.75—2 cm. plus minusve contractum, acutum, basi acutum,

nervis 7 majoribus pluribusque tenuibus sicco supra subtusque prominentibus, papyraceum, c. 15—7.5 cm. longum, 2.3—0.85 cm. latum; petiolus tenuis, canaliculatus, c. 2—1.3 cm. longus. Inflorescentiae ex innovationibus, multiflorae, pedunculo filiformi, c. 5—2.5 cm. longo, rachide leviter flexuosa, compresso-quadrangula, lateribus angustis sulcata, parce vel parcissime muriculato-puberula, c. 8.5—5 cm. longa, internodiis c. 0.3 cm. longis. Bracteae pedicellum amplectentes, late subseptemangulato-ovatae, irregulariter marginatae, epunctatae, c. 0.37 cm. longae, 0.34 cm. latae. Flores ad c. 26, in rachidis lateribus latis siti, patentes, bene 0.7 cm. lati. Sepalum dorsale leviter sigmoideum, apice recurvulum, subelliptico-oblongum, breviter triangulo-acutum, 3nervium, c. 0.5 cm. longum, 0.18 cm. latum. Sepala lateralia oblique subelliptico-oblonga, acuta, medio secundum costam mediam canaliculata cum lateribus convexis, 3nervia, costa media dorso prominente, c. 0.5 cm. longa, 0.18 cm. lata. Petala e basi contracta angulato-elliptico-oblonga, acuta, erosula, canaliculata cum lateribus convexis, 3nervia, c. 0.44 cm. longa, 0.2 cm. lata. Labellum parallelum gynostemio porrectum, vix 3lobum, 3nervium, costis 2 longitudinalibus parallelis brevibus basi supra basin labelli costula transversa medio retusa connexis in basi lobi intermedii evanescentibus, c. 0.4 cm. longum; lobi laterales abbreviati, antice in dentem minimum triangulum producti, suberosuli, leviter convexi, hypochylium transverse quadrangulum basi obtusangulum subtus sulcis 2 longitudinalibus convexo-tricostatum c. 0.12 cm. longum 0.15 cm. latum formantes; lobus intermedius porrectus, hypochylio multo latior, late ovatus, vix acuminatus, acutus ad obtusus, subrepandulus, c. 0.275 cm. longus, 0.33 cm. latus. Gynostemium parvum, subrectum, c. 0.14 cm. longum, alis lateralibus e medio gynostemii, lineari-subulatis, sigmoideis, alam apicalem gynostemium continuam concavam transverse quadrangulam 3—2dentatam aequantibus vel paululum superantibus, pede 0. Anthera cucullata, late ovato-triangula, apice recurva, connectivo valde gibboso, basi 2lobula, c. 0.05 cm. lata. Rostellum incurvum, canaliculatum, triangulum, acutum. Stigma conspicuum, suborbiculare, margine elevatum. Ovarium 6sulcatum, cum pedicello aequilongo vix tenuiore c. 0.2 cm. longum.

Sumatra: West coast, Korintji Peak, 2200—2400 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER nrs. 1025, 10117 and 10445, May 1920).

In habit this resembles *D. acuminatum* J. J. S. but the inflorescences are much shorter and laxer with fewer and larger flowers, the sepals and petals broader, the hypochyl much narrower than the midlobe with far less conspicuous ridges and the midlobe very shortly acuminate.

The flowers are said to be light green with the lip a litthe darker green in the centre. The flowers preserved in alcohol have the hypochyl bordered brown.

Description from herbarium and flowers preserved in alcohol.

Dendrochilum (sect. Monochlamys) **adpressibulbum** J. J. S. n. sp.

Rhizoma dependens, elongatum, valde ramosum, teres, sicco ochrascens, 80 cm. superans, initio vaginis tubulosis dense prominenter nervosis tectum, ramis erecto-patentibus, internodiis ad c. 3.5 cm. longis, superioribus decrescentibus, radicibus crassis. Pseudobulbi ad c. 8.5 cm. dissiti, superiores densiores, breves, rhizoma continui et eo adpressi, subsemiteretes, facie rhizomati adpressa plani vel leviter concavi, apice reniformes, validiores c. 1.1 cm. longi, in ramulis minus validi, tenuiores sed longiores, ad c. 1.75 cm. longi. Folium petiolatum, ovato- vel subovato-oblongum, sensim longe acuminatum, anguste obtusum ad acutiusculum, plus minusve apiculatum, basi rotundatum obtusum ad acutiusculum, nervis majoribus c. 7 sicco subtus tenuiter prominentibus, coriaceo-papyraceum, ad c. 10—11 cm. longum, 3.6—3.8 cm. latum, superiora minora; petiolus canaliculatus, ad c. 1.3—1.5 cm. longus. Inflorescentia in pseudobulbo immaturo folio fere evoluto synantha, nutans, laxe multiflora, pedunculo filiformi, c. 3.5—4.5 cm. longo, rachide leviter flexuosa, a latere compresso-quadrangula, lateribus angustis canaliculata, c. 10—11 cm. longa, internodiis c. 0.3 cm. longis. Bracteae patentissimae, marginibus involutae, triangulae, subquinquangulares, acutae, trinerviae, c. 0.425 cm. longae, 0.35 cm. latae, infima adpressa, sterilis. Flores patentissimi, valde aperti, c. 0.73 cm. lati. Sepalum dorsale lanceolatum, breviter acute acuminatum, apice canaliculatum, 3nervium, fere 0.5 cm. longum, 0.15 cm. latum. Sepala lateralia divergentia, oblique lanceolata, apicem versus angustata, acuta, subfalcatula, angulato-canaliculata cum lateribus convexis, 3nervia, fere 0.5 cm. longa, 0.16 cm. lata. Petala patentissima, oblique oblongo-rhombea, acuta, vix falcatula, erosula, 3nervia, c. 0.425 cm. longa, 0.175 cm. lata. Labellum apice recurvum, 3lobum, 3nervium, totum c. 0.33 cm. longum, appendice transversa subquadrangula utrinque in lamellam erectam longitudinalem brevem oblique semiovalem rotundatam lateraliter compressam producta postice concavo-bilobulata supra basin in hypochylio, lamellis intus ad basin incrassatione connatis; lobi laterales basilares, adscendentes, oblique trianguli, basi truncati, antice non in dentem producti, minute denticulati, convexi, subtus concavi, hypochylium transversum aequilateraliter trapeziforme c. 0.1 cm. longum basi 0.18 cm. apice 0.14 cm. latum formantes; lobus intermedius quinquangulari-rhombeus, breviter triangulo-acuminatus, acutus, superne canaliculatus cum lateribus convexis, subpapillato-repandulus, fascia leviter convexa longitudinali ad basin, c. 0.23 cm. longus, infra medium bene 0.2 cm. latus. Gynostemium brevissimum, dorso angulato-convexum, c. 0.13 cm. longum, alis lateralibus porrectis, oblique sublanceolatis, falcatulis, acutiusculis, alam apicalem transverse subquadrangulam apice irregulariter 3dentatam paulo superantibus. Anthera abscondita, parva, cucullata, basi bilobula, c. 0.05 cm. lata, connectivo gibboso. Rostellum erecto-patens, triangulum, apice recurvum, concavum cum lateribus convexis. Stigma semilunatum, cum rostello angulato suborbiculare, margine inferiore bene

elevatum. Ovarium 6sulcatum, c. 0.1 cm. longum; pedicellus 0.13 cm. longus.

Sumatra: Padangsche Bovenlanden, Goenoeng Talang, 1800 m., in forest. (H. A. B. BÜNNEMEIJER n. 5233, October 1918). As quoted, 2500 m., in underbrush. (H. A. B. BÜNNEMEIJER n. 5502, November 1918).

Near *D. incurvibrachium* J. J. S. but with shorter semiterete pseudobulbs which are pressed against the rhizome, shorter and laxer inflorescences, triangular acute bracts, larger flowers, a broader and different hypochyl.

Another very near ally is *D. elegans* SCHLTR. from Boekit Djarat, Sumatra, which, as the authentic specimen in Buitenzorg shows, has also ovate leaves, but a shorter peduncle, different lip much broader over the hypochyl than over the narrow oblong midlobe, and long narrow linear side wings of the column, much surpassing the terminal wing.

"Flowers light green, lip brown and light green." (BÜNNEMEIJER).

Description from herbarium and flowers preserved in alcohol.

Dendrochilum (sect. Monochlamys) **ramosissimum** J. J. S. nom. nov. — *Platyclinis ramosissimus* RIDL. in Journ. Fed. Mal. St. Mus. VIII (1917), 89.

Rhizoma elongatum, dependens, ramosum, teres, basi radicans, c 50 cm. longum, internodiis ad c. 2.7 cm. longis, superioribus brevioribus, vaginis tenuiter nervosis, sparse fusce punctatis, ad c. 3 cm. longis. Pseudobulbi ad c. 4.5 cm. distantes, rhizoma continui, adpressi ad erecto-patentes, tenues, sicco crassitudinem rhizomatis fere aequantes, facie rhizoma versus spectante canaliculati, ad c. 1.75—3.5 cm. longi. Folium anguste lanceolatum, c. 2.5—3.5 cm. infra apicem contractum, acutum, basi acutum, nervis c. 5—7 majoribus pluribusque tenuibus sicco subtus prominentibus, papyraceum, c. 7—13.5 cm. longum, 1—2 cm. latum; petiolus canaliculatus, c. 0.6—1.25 cm. longus. Inflorescentia e pseudobulbo novello immaturo folio novello plerumque subevoluto synantha, laxe multiflora, pedunculo tenuissime filiformi, c. 4—5.5 cm. longo, rachide compresso-quadrangula, lateribus angustis canaliculata, c. 6.75—13 cm. longa, internodiis c. 0.4—0.45 cm. longis. Bracteae pedicellum amplectentes et superantes, convolutae, late ovatae, acuminatae, acutae, apiculatae, basi breviter et late contractae, dorso parce punctatae, nervis 3 longis 4 brevibus, c. 0.4 cm. longae, 0.27 cm. latae. Flores c. 1 cm. longi, 0.7 cm. lati vel paulo majores. Sepalum dorsale erectum, leviter canaliculato-concavum cum lateribus leviter convexis, subovato-lanceolatum, acutum, 3nervium, c. 0.575 cm. longum, 0.15 cm. latum. Sepala lateralia decurva, subparallela, canaliculata cum lateribus leviter convexis, oblique ovato-lanceolata, sensim acuminata, acuta, breviter apiculata, 3nervia, costa media dorso prominente, c. 0.525 cm. longa, 0.16 cm. lata. Petala divaricata, incurvula, leviter obtusangule canliculata cum lateribus leviter convexis, oblique subrhombeo-lanceolata, acutissima, superne vix erosula, 3nervia, bene 0.5 cm. longa, 0.15 cm. lata. Labellum

supra basin recurvum, laxe undatum, 3 lobum, 3nervium, lamellis 2 remotis longitudinalibus parallelis erectis brevibus altis bene semiorbicularibus in basin lobi intermedii breviter decurrentibus supra basin labelli costula transversa humiliore connexis, expansum c. 0.4 cm. longum; lobi laterales basilares, patentissimi, breves, oblique semiorbiculares, apice vix dentiformi-producti, parce denticulati, convexi, hypochylium transverse oblongo-ovale fere 0.1 cm. longum 0.2 cm. latum formantes; lobus intermedius marginibus lateralibus incurvulis concavus, rhombeo-quinquangularis, acute acuminatus, superne irregulariter marginatus, medio hypochylio vix angustior, c. 0.3 cm. longus, basi 0.125 cm., medio fere 0.2 cm. latus. Gynostemium minutum, curvulum, dorso obtusangule convexum, supra visum ambitu oblongum, superne leviter dilatatum, c. 0.13 cm. longum, alis lateralibus subnullis, in utraque antherae parte lobulum parvum rotundatum formantibus, ala apicali transverse quadrangula, apice 2—3dentata, concava, pede 0. Anthera parva, cucullata, truncato-ovata, apice recurvula, connectivo valde oblique conico-gibboso, c. 0,05 cm. lata. Rostellum patentissimum, semiorbiculare, apiculatum, subtus convexum. Stigma subquadratum, margine elevatum. Ovarium obtuse trigonum, 6sulcatum, c. 0.07 cm. longum; pedicellus fere aequicrassus, bene 0.1 cm. longus.

Sumatra: West coast, Korintji Peak, 2400—2750 m. (H. A. B. BÜNNEMEIJER nrs. 9774, 9846 and 9933, April—May 1920).

I have little doubt that *Platyclinis ramosissimus (a)* RIDL. is intended for this plant, only RIDLEY says that the scape is produced when the leaf is quite young and undeveloped, whereas in my plants the leaf in the majority of the flowering sprouts is nearly full-grown. The stigma I find not being larger than in the allied species and the apex of the clinandrium is 2—3dentate.

The flowers have been described by the collector as light green (n. 9774), light green with a darker green lip (n. 9933) and light green with a brownish green blotch on the lip (n. 9846). In the flowers preserved in alcohol the side lobes of the lip have brown margins, the midlobe shows 2 brown blotches and the transversal ridge connecting the basal lamellae is also brown.

Description from herbarium and flowers preserved in alcohol.

Dendrochilum (sect. Monochlamys) **decipiens** J. J. S. n. sp.

Rhizoma elongatum, ramosum, teres, basi tantum radicans, pars adest 50 cm. longa, internodiis ad c. 3.5 cm. longis, vaginis acutis, sicco dense prominule nervosis, epunctatis, opacis, ad c. 4.5 cm. longis. Pseudobulbi ad c. 12.5 distantes, rhizoma continui, cum rhizomate angulum anguste acutum facientes, semiteretes (sicco), facie rhizoma versus spectante applanati, inferne concavi, crassitudine rhizomatis, ad c. 2.9 cm. longi. Folium majusculum, petiolatum, elliptico-lanceolatum, in c. 1.6—3.5 cm. infra apicem

contracto-acuminatum, acutum vel obtusiusculum, basi acutum, nervis c. 7 majoribus pluribusque tenuibus sicco supra subtusque prominulis, firmiter papyraceum, subsemipellucidum, opacum, c. 8.5—14 cm. longum, 2—3.5 cm. latum; petiolus canaliculatus, c. 0.9—1.1 cm. longus. Inflorescentia in pseudobulbo immaturo folio haud vel vix evoluto synantha, laxe multiflora, pedunculo filiformi, c. 5 cm. longo, rachide arcuato-recurva, flexuosa, compresso-quadrangula, glabriuscula, lateribus angustis canaliculata, c. 10 cm. longa, internodiis c. 0.35 cm. longis. Bracteae convolutae, pedicellum amplectentes, late ovatae, breviter acutae, basi brevissime contractae, nervis 5 majoribus et nonnullis minoribus dorso prominentibus, bene 0.4 cm. longae, 0.34 cm. latae. Flores mediocres, patentes. Sepalum dorsale obtusangule canaliculatum, lateribus leviter convexis, lanceolatum, sensim longiuscule acuminatum, acutum, 3nervium, c. 0.65 cm. longum, 0.175 cm. latum. Sepala lateralia obtusangule concava, lateribus leviter convexis, apice recurvula, oblique lanceolata, sensim longe acutata, acuta, 3nervia, ecarinata, c. 0.65 cm. longa, 0.175 cm. lata. Petala suboblique elliptico-lanceolata, leviter acuminata, acuta, obtusangule concava, 3nervia, basi excepta minute erosula, bene 0.6 cm. longa, fere 0.2 cm. lata. Labellum gynostemio parallelum porrectum, 3lobum, 3nervium, lamellis 2 longitudinalibus parallelis erectis rotundatis duplo longioribus quam altis hypochylio aequilongis basi supra basin labelli costa transversa antice minute bicallosa connexis in hypochylio, c. 0.44 cm. longum; lobi laterales patentissimi, breves, lati, antice in dentes 1—2 minimos irregulares abientes, erosuli, hypochylium conspicuum lobo intermedio fere aequilatum transverse quadrangulum basi utrinque rotundatum subtus sulcis 2 longitudinalibus convexo-tricostatum c. 0.16 cm. longum bene 0.2 cm. latum formantes; lobus intermedius porrectus, lateribus incurvulis concavus, apice recurvulus, ovatus, acute acuminatus, basi breviter et late angustatus, erosulus, c. 0.28 cm. longus, 0.25 cm. latus. Gynostemium minutum, subrectum, dorso obtusangule convexum, oblongum, totum c. 0.13 cm. longum, alis lateralibus supra medium ortis, incurvulis et sub ala apicali decussatis, lineari-filiformibus, alam apicalem porrectam subtus vix concavam 2dentatam bene superanibus, pede subnullo. Anthera cucullata, a dorso compressa, antice visa ovata, apice obtusa recurvulaque, connectivo sensim alte rotundato-conico-incrassato, c. 0.04 cm. lata. Pollinia 4, pyriformia. Rostellum majusculum, cum clinandrio angulum acutum faciens, subsemiorbiculare, canaliculato-concavum, apiculo recurvulo. Stigma semilunatum, cum rostello suborbiculare, margine elevatum. Ovarium breve, rotundato-subtrigonum, 6sulcatum, fere 0.1 cm. longum, cum pedicello subaequicrasso c. 0.16 cm. longo angulum obtusum faciens.

Sumatra: West coast, Korintji Peak, 1800 m., in forest. (H. A. B. BÜNNEMEIJER n. 9704, April 1920).

In habit this plant resembles closely *D. latilobum* J. J. S., only the sheaths are punctate. The flowers, however, are much larger, the sepals

and petals very acute, the lip longer with a large hypochyl almost as broad as the midlobe and longer lower lamellae, the column less bent and with nearly linear stelidia surpassing the bidentate clinandrium and a very different anther.

The flowers are said to be light brown with a dark brown lip.

Description from a single dried specimen with one inflorescence, the upper part of which was preserved in alcohol.

Dendrochilum (sect. Monochlamys) **latilobum** J. J. S. n. sp.

Rhizoma elongatum, ramosum, validiusculum, teres, basi tantum radicans, pars adest 25 cm. longa (planta vel caulis juvenilis?), internodiis ad c. 2 cm. longis, vaginis adpressis acutis sicco prominenter nervosis atropunctatis ad c. 4.5 cm. longis, radicibus tenuiusculis. Pseudobulbi ad. c. 6.5 cm. distantes, rhizoma continui, subadpressi vel cum rhizomate angulum acutum facientes, sicco teretes et rhizomate aequicrassi, facie rhizoma versus spectante non canaliculati, ad bene 4 cm. longi. Folium elliptico-oblongum ad lanceolatum, apice longitudine 0.7—2.75 cm. semel vel bis contractum, angustatum, anguste obtusum, apiculatum, basi acutum, nervis majoribus c.9 pluribusque tenuibus sicco supra subtusque prominentibus, coriaceum, supra nitidulum, subtus opacum, c. 6.7—11 cm. longum, 2.35—3 cm. latum; petiolus distinctus, canaliculatus, c. 0.7—1.1 cm. longus. Inflorescentia e pseudobulbo immaturo, folio evoluto synantha, dense multiflora, pedunculo filiformi, c. 5.5—7 cm. longo, rachide nutante, validiuscula, leviter flexuosa, compresso-quadrangula, lateribus angustis canaliculata, parcissime et minute muriculata, c. 9 cm. longa, internodiis c. 0.15—0.175 cm. longis. Bracteae convolutae, pedicellum amplectentes et superantes, late angulato-ovatae, acutae, basi breviter contractae, nervis 5 imperfectis dorso prominentibus, parce punctatae, c. 0.3 cm. longae et latae, infima longior (an semper?). Flores patentissimi. Sepalum dorsale secundum costam mediam canaliculatum cum lateribus leviter convexis, subovato-oblongum, breviter acutum, 3nervium, c. 0.4 cm. longum, 0.16 cm. latum. Sepala lateralia obtusangule canaliculata cum lateribus leviter convexis, suboblique subovato-oblonga, acuta, 2—3nervia, costa media dorso prominente, c. 0.4 cm. longa, 0.16 cm. lata. Petala suboblique subelliptico-oblonga, acuta, superne vix irregulariter marginata, concava, 3nervia, c. 0.33 cm. longa, 0.16 cm. lata. Labellum parallelum gynostemio porrectum, vix curvulum, breve, subtrilobum, 3nervium, lamellis 2 remotis longitudinalibus erectis brevibus altis semiovalibus basi supra basin labelli costa transversa connexis in hypochylio, explanatum c. 0.3 cm. longum; lobi laterales abbreviati, patentissimi, antice in dentem minutum triangulum producti, irregulariter marginati, convexi, hypochylium transverse oblongo-quadrangulum subtus sulcis 2 longitudinalibus convexo-tricostatum c. 0.08 cm. longum 0.18 cm. latum formantes; lobus intermedius hypochylio multo latior, late triangulus, subquinquangulatus, brevissime acuminatus, angulis lateralibus obtusis, leviter convexus, nervis

elevatis, bene 0.2 cm. longus, 0.3 cm. latus. Gynostemium parvum, curvatum, dorso convexum, supra visum ambitu obovato-ovale, c. 0.14 cm. longum, alis lateralibus paulum supra medium gynostemii ortis, erecto-patentibus, incurvulis, oblique oblongis, ala apicali aequilateraliter trapeziformi truncata repandulo-denticulata concava paulo brevioribus, pede 0. Anthera minuta, cucullata, breviter ovata, apice recurvo spurie truncata, connectivo basi oblique gibboso, fere 0.04 cm. lata. Rostellum breviusculum, aequilateraliter trapeziforme, apiculatum. Stigma rotundato-quadratum, margine elevatum. Ovarium rotundato-trigonum, 6sulcatum, c. 0.1 cm. longum; pedicellus cum ovario angulum obtusum faciens, c. 0.08 cm. longus.

Sumatra: West coast, Korintji Peak, 1600 m., forest. (H. A. B. BÜNNEMEIJER n. 8675, March 1920).

In the form of the lip this is nearest to *D. longicaule* J. J. S., from which it differs in the broader leaves, denser inflorescence, shorter lip with much higher lamellae, broad stelidia.

The collector describes the flowers as light brown. In the flowers preserved in alcohol the midlobe of the lip shows two brown blotches and the ridge connecting the lamellae between the side lobes is also brown.

Description from a single dried specimen the upper part of the raceme being preserved in alcohol.

Dendrochilum (Sect. Platyclinis) **duplicibrachium** J. J. S. n. sp.

Rhizoma breve, ramosum, teres, initio vaginatum. Pseudobulbi rhizoma continui, approximati, elongati, tenues, teretes, apicem versus attenuati, pallide opaco-virides, c. 5—11 cm. longi, basi 0.5—0.7 cm. diam., 1folii, vaginis magnis tubulosis subacuminatis acutissimis opace viridibus atrofusce furfuraceo-marmoratis ad c. 9 cm et plus longis ad basin. Folium erectum, petiolatum, lanceolatum, apice canaliculatum, acutum, basi acuta abrupte in petiolum contractum, costa media supra sulcata subtus obtuse prominente, tenuiter coriaceum, supra nitidule viride, subtus opacum et minute furfuraceo-punctatum, c. 18 cm. longum, 1.5—3.3 cm. latum, petiolo canaliculato, inferne tereti cum sulco longitudinali, c. 4.25 cm. longo. Inflorescentia multiflora, pedunculo filiformi, dilute viridi, furfuraceo-punctato, c. 13 cm. longo, rachide pendula, flaccida, postice et antice sulco longitudinali instructa, dilute viridi, c. 12.5 cm. longa, internodiis c. 0.3 cm. longis. Bracteae pedicellum amplectentes et multo superantes, oblongo-triangulae, leviter acuminatae, acutae, basi utrinque paulum decurrentes, trinerviae, tenerae, 3nerviae, ad c. 0.525 cm. longae, 0.25 cm. latae. Flores patentissimi, haud valde aperti, sepalis petalisque conniventibus, apice recurvulis, fuscis, margine inferne et basi dilute viridibus. Sepalum dorsale anguste lanceolatum, apicem versus sensim angustatum, acutum, concavum, margine recurvum, c. 0.63 cm. longum, 0.16 cm. latum. Sepala lateralia oblique lanceolata, vix falcatula, apicem versus sensim angustata vel plus minusve acuminata, acuta, canaliculata, margine convexo-

recurva, costa media dorso prominente, c. 0.63 cm. longa, 0.16 cm. lata. Petala oblique lanceolata, acute acuminata, in utraque parte canaliculae longitudinalis convexa, obsolete erosula, albido-marginata, c. 0.53 cm. longa, 0.15 cm. lata. Labellum curvulum, $^2/_5$ partibus superioribus revolutum, subsimplex, minutissime papillosum, inferne marginibus erectis concavum, cinnamomeum, margine pallidius, basi dilute viride, explanatum oblongum, in c. $^2/_5$ partibus supra basin leviter constrictum, c. 0.36 cm. longum, hypochylio subquadrato, margine erosulo-denticulato, costulis 3 parallelis intermedia minus conspicua instructo, c. 0.12 cm. longo, 0.13 cm. lato, epichylio (lobo intermedio) ovato, obtuso, convexo, minutissime erosulo, c. 0.22 cm. longo, 0.15 cm. lato. Gynostemium subundatum, dorso convexum, pallide viride, c. 0.25 cm. longum, alis lateralibus magnis, basi lata basin gynostemii fere et clinandrium attingentibus, oblique lanceolato-triangulis, sensim angustatis, acutis, falcatis, albis, alam terminalem cum gynostemio angulum obtusum facientem oblongam irregulariter erosulo-crenulatam viridi-albam aequantibus, dente brevi triangulo albo utrinque in sinu inter alam apicalem et alas laterales, pede abbreviato. Anthera cucullata, cordata, subacuminata, acuta, carneo-alba, c. 0.08 cm. longa, connectivo incrassato, pallide viridi. Pollinia 4, inaequalia, oblique compresso-clavata, basi acuta, dilute flava, ad 0.075 cm. longa. Rostellum majusculum, 5angulare, leviter convexum, fuscescens. Stigma magnum, longitudinale, oblongo-quadrangulum, prominens, concavum, margine inferiore elevatum truncatum et pallide fuscum, ceterum olivaceum. Ovarium pedicellatum breve, obtuse trigonum, 6sulcatum, viride, c. 0.16 cm. longum.

Sumatra: Benkoelen, Boekit Barisan, Rimbo Pengadang 1000 m. (Exp. E. JACOBSON 1916, AJOEB, liv. pl. cult. in Hort. Bog. sub nrs. 803 and 878).

Allied to *D. simile* BL. and perhaps nearest to *D. odoratum* (RIDL.) J. J. S., from which it may be distinguished by the colour of the flowers, the denticulate lip with three longitudinal keels on the lower half and the form of the column.

Description from a living specimen.

Dendrochilum (sect. Platyclinis) **ventricosum** J. J. S. n. sp.

Rhizoma valde ramosum, vaginis brevibus infra pseudobulbos accrescentibus tubulosis imbricantibus breviter acutis sicco dense prominenter nervosis glabris opacis ad c. 4.5 cm. longis tectum. Pseudobulbi approximati, sicco teretes, c. 1.5—3.4 cm. longi. Folium lanceolatum, basi acuta breviter petiolato-contractum, c. 0.3—0.65 cm. infra apicem contractum, obtusum vel acutum et brevissime conduplicatum, saepe plus minusve apiculatum, nervis c. 7 majoribus subtus prominentibus, papyraceum, c. 5.25—18 cm. longum, 0.675—1.9 cm. latum; petiolus canaliculatus, c. 0.25—1.8 cm. longus. Inflorescentia synantha in pseudobulbis subevolutis, erecta,

sublaxe multiflora, pedunculo filiformi, c. 6.5—13.5 cm. longo, rachide leviter flexuosa, lateraliter compresso-quadrangula, lateribus angustis sulcata, c. 6.5—11 cm. longa, internodiis c. 0.2—0.5 cm. longis. Bracteae conspicuae, patentes, pedicellum et floris partem inferiorem amplectentes, involutae, abbreviato-orbiculares, c. 7nerviae, c. 0.6 cm. longae, 0.63 cm. latae, 4—6 inferiores steriles, adpressae, imbricatae. Flores mediocres, glabri, c. 0.75 cm. lati, 0.775 cm. longi, sepalis basi contiguis. Sepalum dorsale ovarium continuum, apice recurvulum, anguste lanceolatum, acutum, leviter concavum, 3nervium, c. 0.775 cm. longum, 0.175 cm. latum. Sepala lateralia erecto-patentia, supra basin concavam basin labelli amplectentem divergentia, apice recurva, anguste obliquè lanceolata, apicem versus sensim angustata, acuta, obtusangule concava cum lateribus leviter convexis, apice canaliculata, 3nervia, costa media dorso prominula, c. 0.775 cm. longa, 0.14 cm. lata. Petala erecta, sepalo dorsali adpressa, subparallela, vix divergentia, oblique lanceolata, acuminata, acuta, basi leviter contracta, superna erosula, leviter concava, 3nervia, c. 0.675 cm. longa, 0.18 cm. lata. Labellum immobile, erectum, simplex, supra basin canaliculato-concavam marginibus erectam valde excavato-concavum subtus ventricosum, superne late canaliculato-concavum cum marginibus convexis, dentibus marginalibus minutis patentibus acutis c. 2 utrinque in $^1/_4$—$^1/_3$ parte supra basin, 3nervium, lamellis 2 parallelis altis tenuibus brevibus abrupte terminantibus basi transverse conjunctis, supra basin callo breviore antice incrassato et retuso interposito, explanatum obverse quinquangulari-rhombeum, acuminatum, acutum, superne papillosum, c. 0.66 cm. longum, supra basin c. 0.225 cm., superne 0.36 cm. latum. Gynostemium brevissimum, dorse angulato-convexum, c. 0.15 cm., usque apicem alarum lateralium 0.175 cm. longum, alis lateralibus e dimidio inferiore, porrectis, parallelis, linearibus, vix falcatulis, oblique acutis, alam apicalem superantibus, ala apicali porrecta, concava, dorso convexa, quadrangula, apicem versus paulo angustata, truncata, irregulariter denticulata, pede subnullo. Anthera cucullata, ambitu ovato-triangula, apice triangulo subacuto recurva, basi bilobula, bene 0.05 cm. lata, connectivo crasse obtuse gibboso. Pollinia 4, pyriformia, caudiculis filiformibus. Rostellum erecto-patens, semiovale, rotundatum, apice subproductum, concavum, subtus convexum. Stigma semiovale, margine inferiore rotundatum et paulo elevatum. Ovarium brevissimum, 6sulcatum, c. 0.06 cm. longum; pedicellus aequicrassus, c. 0.1 cm. longus.

Sumatra: Padangsche Bovenlanden, Laras Talang, Boekit Gombak, 1450 m., in a coffee plantation. (H. A. B. BÜNNEMEIJER n. 5622, November 1918). Goenoeng Talang, 1300 m., on a tree. (H. A. B. BÜNNEMEIJER n. 5655, November 1918).

A very distinct species allied to *D. edentulum* BL., with the bracts inwrapping the basal portion of the flowers, and the lip ventricose above the base.

„Flowers green". (BÜNNEMEIJER).
Description from dried specimens and flowers preserved in alcohol.

Dendrochilum (sect. Platyclinis) **rigidulum** J. J. S. n. sp.

Rhizoma valde ramosum. Pseudobulbi approximati, cylindrici, obtusi, c. 2.5—3.75 cm. longi, 0.5—0.65 cm. diam. (in sicco), vaginis superne accrescentibus sicco dense prominenter nervosis et dense minutissime elevato-puncticulatis opacis ad c. 4 cm. longis ad basin. Folium sublineare, apice subconduplicato subacutum vel brevissime acutum, subpungens, basi acuta in petiolum brevem canaliculatum c. 0.8—1.5 cm. longum angustatum, rigidulum, nervis 5—7 sicco subtus prominentibus, totum c. 10—15 cm. longum, 0.475—1 cm. latum (in sicco). Inflorescentia e pseudobulbo maturo, erecta, superne nutans, laxius multiflora, pedunculo filiformi, c. 6.5—11.5 cm. longo, rachide leviter flexuosa, compresso-quadrangula, c. 12—18 cm. longa, internodiis c. 0.25—0.325 cm. longis. Bracteae ovarium pedicellatum plus minus aequantes, amplectentes, late subovatae, obtusae, vix apiculatae, basi contractae, 3nerviae, c. 0.37 cm. longae et latae, 2—4 inferiores steriles, adpressae, imbricantes. Flores alternatim bifarii, patentes. Sepalum dorsale subrhombeo-lanceolatum, acutum, 3nervium, c. 0.5 cm. longum, 0.175 cm. latum. Sepala lateralia oblique oblonga, acuta, dorso carinata, 3nervia, c. 0.5 cm. longa, fere 0.2 cm. lata. Petala subrhombeo-lanceolata, acuta, 3nervia, c. 0.48 cm. longa, 0.16 cm. lata. Labellum subtrilobum, concavum, 3nervium, callis 2 brevibus erectis lateraliter compressis rotundatis postice lamella transversa postice incrassata rotundata conjunctis ad basin, explanatum totum c. 0.44 cm. longum, hypochylio transverse quadrangulo, basi utrinque in lobulum parvum rotundatum dilatato, suberosulo, bene 0.2 cm. lato, lobo intermedio late ovato, acuminato, acuto, margine papilloso, c. 0.3 cm. longo, fere 0.3 cm. lato. Gynostemium brevissimum, dorso convexum, c. 0.13 cm. longum, ala apicali transverse quadrangula, apice leviter rotundata, denticulata, alis lateralibus infra medium insertis, apicali brevioribus, patentibus, oblique oblongis, apice dilatatis, obtusis. Pollinia 4, oblique clavata. Rostellum triangulum. Stigma margine inferiore valde elevato oblique cupuliforme. Ovarium breve, 6sulcatum, pedicello fere aequicrasso.

Sumatra: Ophir districts, Goenoeng Talamau, northwestern slope, 1700 m. (H. A. B. BÜNNEMEIJER n. 767a, May 1917). Korintji Peak, 1200—1700 m, on trees in forest. (H. A. B. BÜNNEMEIJER nrs. 8537, 8607, 8919, 8958, 8960, 8990 and 9073, March 1920).

In general this is similar to *D. cornutum* BL., differing chiefly in the short broad column arms and the form of the lip.

The flowers are described as light green.

Description from the dried Ophir specimen only.

Dendrochilum (sect. Platyclinis) **ophiopogonoides** J. J. S. n. sp.

Rhizoma valde ramosum, adscendens, vaginis tubulosis imbricantibus versus basin pseudobulborum accrescentibus dense prominenter nervosis opacis parce inconspicue punctatis saltem superioribus acutis ad c. 5.5 cm. longis tectum. Pseudobulbi dense aggregati, rhizoma continui, sicco tenuiter teretes, c. 3—4 cm. longi. Folium lineare, apicem versus angustatum, acutum vel anguste obtusum, plus minusve apiculatum, basi acuta breviter petiolato-angustatum, nervis majoribus c. 5 dorso prominentibus, rigidum, sicco subsemipellucidum, c. 13.5—16 cm. longum, 0.6—0.73 cm. latum; petiolus canaliculatus, c. 1.5 cm. longus. Inflorescentia in pseudobulbo immaturo folio fere evoluto synantha, pedunculo tenuiter filiformi, c. 15—17 cm. longo, rachide leviter flexuosa, valde lateraliter compresso-quadrangula, lateribus angustis sulcata, sparse et minutissime muriculato-puberula, c. 8—11.5 cm. longa, internodiis c. 0.275—0.3 cm. longis. Bracteae ovarium superantes, marginibus involutae, late ovatae, acute apiculatae, basi breviter contractae, irregulariter marginatae, nervis c. 5 dorso prominentibus, c. 0.35 cm. longae, 0.3 cm. latae, 2 inferiores steriles. Flores parvuli, bene aperti, c. 0.85 cm. lati. Sepalum dorsale lanceolatum, apicem versus angustatum et recurvulum, acutum, concavum, 3nervium, c. 0.47 cm. longum, 0.15 cm. latum. Sepala lateralia divaricata, oblique lanceolata, apicem versus angustata, acuta, obtusangule canaliculata, cum lateribus convexis, 3nervia, costa media dorso prominula, c. 0.5 cm. longa, 0.15 cm. lata. Petala oblique lanceolata, acuminata, acuta, supra basin leviter constricta, leviter canaliculata cum lateribus leviter convexis, $^3/_5$ partibus superioribus erosa, 1nervia, nervo dorso prominulo, c. 0.46 cm. longa, 0.1 cm. lata. Labellum porrectum, leviter sigmoideum, 3lobum, concavum, subtus convexum cum costa longitudinali convexa in parte inferiore, 3nervium, costis 2 satis conspicuis brevibus parallelis basi lamella transversa altiore calliformi a dorso compressa conjunctis infra basin lobi intermedii evanescentibus supra basin inter lobos laterales, explanatum c. 0.45 cm., usque apicem loborum lateralium c. 0.24 cm longum, ad lobos laterales 0.3 cm. latum; lobi laterales patentes, porrecti, oblique oblongi, apice plus minusve recurvuli, oblique subtruncati vel obtusi, margine exteriore erosuli, extus convexi intus concavi, gynostemium bene superantes; lobus intermedius porrectus, leviter adscendens, apice recurvulus, obverse rhombeus, breviter acute acuminatus, inferne marginibus recurvus, apice canaliculatus, parte superiore erosulus, c. 0.26 cm. longus, 0.2 cm., basi 0.14 cm. latus. Gynostemium brevissimum, latum, c. 0.15 cm. longum, alis lateralibus in dimidio inferiore, patentibus, porrectis, incurvulis, verticalibus, oblique oblongis, acutiusculis, intus leviter convexis, alam apicalem aequantibus, ala apicali quadrangula, truncata, apice crenulata, concava, pede 0. Anthera parva, cucullata, abscondita, transverse ovalis, antice visa subconica, basi bilobula, c. 0.03 cm. lata, connectivo conspicuo, crasse gibboso, apicem fere attingente. Rostellum erecto-patens, semiovale, obtusum, apiculatum, concavum, subtus convexum. Stigma subsemilunatum,

margine inferiore obtusangulum vix elevatum. Ovarium 6sulcatum, c. 0.1 cm. longum, pedicello c. 0.15 cm. longo vix crassius.

Sumatra: Padangsche Bovenlanden, Laras Talang. Goenoeng Talang, 2450 m., in brushwood. (H. A. B. BÜNNEMEIJER n. 5501, November 1918).

In spite of the well developed side lobes of the lip this is to be reckoned amongst the nearer allies of *D. cornutum* BL. In a dry state it is easily recognized by the tufted linear stiff transparent leaves, which, I suppose, are fleshy on the living plant.

The flowers are said to be white to light green.

Description from herbarium and an inflorescence preserved in alcohol.

var. **merapiense** J. J. S. n. var.

Rhizoma valde ramosum, vaginis acutis dense prominenter nervosis, opacis, radicibus crassiusculis. Pseudobulbi aggregati, sicco teretes, rugosi, c. 2—3 cm. longi. Folium lanceolato-lineare, apicem versus angustatum, anguste obtusum, subapiculatum, basi acutum, nervis c. 5 majoribus prominentibus, papyraceum, c. 5.5—10 cm. longum, 0.5—1 cm. latum; petiolus c. 0.5 cm. longus. Inflorescentia in pseudobulbo immaturo folio fere evoluto synantha, subdense multiflora, pedunculo tenuiter filiformi, 5—7.25 cm. longo, rachide lateraliter compresso-quadrangula, lateribus angustis sulcata, c. 6.5—8 cm. longa, internodiis c. 0.175—0.225 cm. longis. Bracteae patentes, rachidem semiamplectentes, ovarium pedicellatum marginibus involutis includentes et multo superantes, late ovato-triangulae, obtusae vel subacutae, basi lata utrinque rotundatae, subtrinerviae, c. 0.37 cm. longae et latae, infima sterilis. Flores teneri, c. 1 cm. lati. Sepalum dorsale lanceolatum, apicem versus sensim angustatum, acutissimum, leviter canaliculatum cum lateribus convexis, 3nervium, c. 0.55 cm. longum, 0.16 cm. latum. Sepala lateralia similia, patentissima, obliqua, tenuiter apiculata, 0.16 cm. lata. Petala oblique lanceolata, acutissime acuminata, basi leviter contracta medio tantum affixa, basi excepta erosula, obtusangule concava cum lateribus convexis, 3nervia, c. 0.5 cm. longa, 0.15 cm. lata. Labellum ima basi a gynostemio patens, supra basin incurvo-porrectum, 3lobum, basi lata utrinque rotundata medio tantum insertum, subtus inferne convexum cum costula longitudinali, 3nervium, costis 2 brevibus parallelis basi callo transverso conspicuo antice inter costas minute bigibboso conjunctis basin lobi intermedii non attingentibus supra basin inter lobos laterales, explanatum ambitu subovatum, c. 0.45 cm., usque apicem loborum lateralium 0.2 cm. longum, ad lobos laterales 0.25 cm. latum; lobi laterales satis conspicui, porrecti, oblique oblongi, basi valde obliqui, apice leviter incurvuli, margine exteriore superne erosuli, gynostemium superantes; lobus intermedius adscendens, marginibus recurvis convexus, ovato-ellipticus, acuminatus, acutissimus, erosulus, papillosus, c. 0.33 cm. longus, 0.2 cm. latus. Gynostemium brevissimum, dorso convexum, alis lateralibus in

dimidio inferiore, erecto-patentibus, porrectis, oblique oblongis, acutis, ala apicali bene brevioribus, ala apicali subquadrata, truncata, 3crenata vel irregulariter dentata, concava, pede 0. Anthera abscondita, cucullata, rotundato-triangula, apice rotundata, c. 0.05 cm. lata, connectivo crasse obtuse gibboso apicem non attingente. Rostellum erecto-patens, semiovale, apice apiculato-productum et incurvulum, canaliculatum cum lateribus convexis. Stigma cum rostello subovale, margine inferiore obtusangulum. Ovarium 6sulcatum, c. 0.075 cm. longum, pedicello c. 0.12 cm. longo vix crassius.

Sumatra: West-coast, Goenoeng Merapi, 1800 m., forest. (H. A. B. BÜNNEMEIJER n. 4722, September 1918).

I have given a detailed description of the variety, because it differs slightly but in many respects from the type, especially in the shorter and thinner leaves, the form of the midlobe of the lip, and the shorter arms of the column..

Description from herbarium and an inflorescence preserved in alcohol.

Dendrochilum (sect. Platyclinis) **ovatum** J. J. S. n. sp.

Pseudobulbi approximati, sicco tenues, teretes, c. 5 cm. longi, novelli pluribus vaginis amplectentibus acutis praesertim superne transverse rugulosis opacis atrofusce sed non conspicue punctatis superioribus accrescentibus ad c. 7 cm. longis tecti. Folium petiolatum, anguste lanceolatum, parte superiore c. 6—7 cm. longa leviter contractum, acutum, apiculatum, basi acutum, nervis c. 7 majoribus et numerosis tenuibus sicco subtus prominentibus, firmiter papyracea, c. 14—17,5 cm. longa, 1.75—2 cm. lata; petiolus canaliculatus, c. 1.75—1.9 cm. longus. Inflorescentia in pseudobulbis novellis immaturis folio evoluto synantha, laxius multiflora, pedunculo filiformi, c. 7.25—13 cm. longo, rachide leviter flexuosa, compresso-quadrangula, lateribus angustis canaliculata, c. 15 cm. longa, internodiis c. 0.35—0.4 cm. longis. Bracteae ovarium pedicellatum amplectentes et superantes, ovato-orbiculares, obtusissimae, 5nerviae, c. 0.45 cm. longae, bene 0,4 cm. latae. Flores mediocres, fere 1.3 cm. lati. Sepalum dorsale oblongum, brevissime acutum vel subacuminatum, 3nervium, bene 0.6 cm. longum, 0.24 cm. latum. Sepala lateralia divaricata, oblique ovato-oblonga, apicem versus sensim angustata, acuta, medio canaliculata, lateribus convexa, 3nervia, costa media dorso prominente, c. 0.64 cm. longa, 0.24 cm. lata. Petala vix ovato-oblonga, acuta, superne vix irregulariter marginata, 3nervia, c. 0.575 cm. longa, 0.22 cm. lata. Labellum simplex, concavum, acutum, vix acuminatum, in c. $^1/_3$ parte supra basin utrinque denticulo obsoleto instructum, 3nervium, supra basin 3costatum, costis exterioribus basi tantum satis conspicuis attenuatis in c. $^2/_5$ partibus supra basin evanescentibus, costa tertia breviore basi dilatata et incrassata interposita, costis supra basin labelli connexis, expansum c. 0.53 cm. longum, 0.3 cm. latum. Gynostemium brevissimum, dorso subsigmoideum convexumque, c. 0.18 cm. longum, alis lateralibus porrectis,

dimidium inferius gynostemii occupantibus, latissimis, ala apicali brevioribus, trapeziformibus, obtusis, margine antico postico longioribus, ala apicali brevi, lata, transverse quadrangula, truncata, basi utrinque dente bene breviore satis conspicuo triangulo instructa, pede 0. Anthera cucullata, ambitu late ovata, e basi transverse ovali rostrato-acuminata, obtusa, connectivo basi gibboso, c. 0.075 cm. lata. Polinia 4, oblonga, subpyriformia, cum caudiculis conspicuis c. 0.075 cm. longa. Rostellum conspicuum, latum, subtus convexum. Stigma semilunatum. Ovarium cum pedicello paulo tenuiore c. 0.175 cm. longum.

Sumatra: East coast, Deli, south west of Bandar Baroe, 1000 m., in forest, on a fallen tree. (J. A. LÖRZING n. 5350, October 1917).

This seems to be nearest to *D. brachyotum* RCHB. F. from Java, but the pseudobulbs are longer, the petals far less acutate, the lip hardly acuminate with very different keels, the side wings of the column much broader.

„Young parts more or less tinted with brown. Flowers greenish brown." (LÖRZING).

Description from a dried specimen.

Dendrochilum (sect. Platyclinis) **talamauense** J. J. S. n. sp.

Rhizoma ramosum, initio vaginis tubulosis infra pseudobulbos accrescentibus imbricantibus acutis dense prominenter nervosis opacis vix punctatis ad c. 5.5 cm. longis tectum, radicibus crassiusculis villosis. Pseudobulbi aggregati, ad c. 1.2 cm. dissiti, sicco cylindracei, apicem versus leviter attenuati, sicco transverse rugulosi, c. 3.2—4 cm. longi, 0,6 cm. diam. Folium petiolatum, lanceolatum, apice longitudine 3.75—6 cm. subcontracto-angustatum, in c. 0.3—0.95 cm. infra apicem contractum, breviter acutum vel obtusum, interdum apiculatum, basi acuta abrupte in petiolum contractum, nervis c. 7—9 sicco subtus prominentibus numerosis tenuibus interpositis, sicco papyraceum, c. 10—16 cm. longum, 1.75—2.5 cm. latum; petiolus brevis, canaliculatus, c. 0.8—1.5 cm. longus. Inflorescentia in pseudobulbo fere evoluto, laxe multiflora, pedunculo c. 6.75—8.7 cm. longo, rachide leviter flexuosa, lateraliter compresso-quadrangula, lateribus angustis sulcata, vix punctata, c. 6.75—15 cm. longa, internodiis c. 0.5—0,65 cm. longis. Bracteae patentissimae, marginibus involutae, ovarium superantes, late ovatae, brevissime acuminatae, nervis c. 7 dorso prominulis puncticulatae, c. 0.55 cm. longae, 0,5 cm. latae, infima sterilis, adpressa. Flores majusculi. Sepalum dorsale lanceolatum, subulato-acuminatum, concavum, 3nervium, c. 0.75 1 cm. longum, 0.325 cm. latum. Sepala lateralia, oblique oblongo-ovata, longius subulato-acuminata, obtusangule canaliculata cum lateribus convexis, canaliculo dorso prominente, 3nervia, c. 0.75—1 cm. longa, 0.3—0.37 cm. lata. Petala oblique elliptico-oblonga, acute acuminata, superne erosa, concava, 3nervia, c. 0.675—0.85 cm. longa, 0.33—0.4 cm. lata.

Labellum supra basin et apice recurvum, convexum, subtrilobum, 3nervium, callis 2 conspicuis remotis longitudinalibus brevibus altis a latere compressis subangulato-semiorbicularibus abrupte terminantibus basi costula transversa humiliore retusa conjunctis supra basin inter lobos laterales, explanatum c. 0.6—0.725 cm. longum; lobi lateralis breves, basi lati, leviter rotundati, antice in dentem liberum obsoletum vel minimum triangulum interdum deficientem producti, erosi, hypochylium transverse oblongum c. 0.225—0.27 cm. longum 0.38—0.47 cm. latum formantes; lobus intermedius late ovato-triangulus vel late ovato-rhombeus et basi paulum contractus, brevissime triangulo-apiculato-acuminatus, erosus, apice canaliculatus c. 0.375—0.475 cm. longus, 0.47—0.475 cm. latus. Gynostemium brevissimum, dorso obtusangule convexum, apice medio leviter productum rotundato-truncatum et irregulariter marginatum, c. 0.23 cm. longum, alis lateralibus et pede 0. Anthera cucullata, ambitu ovato-quadrangula, apicem versus angustata, apice late subtruncata, basi bilobula, c. 0.075 cm. lata, connectivo gibbosoincrassato. Rostellum patens, subsemiorbiculare, obtuse apiculatum, medio canaliculatum cum marginibus convexis. Stigma suborbiculare, margine elevatum. Ovarium 6sulcatum, c. 0.15 cm. longum; pedicellus 0.1 cm. longus.

Sumatra: Padangsche Benedenlanden, Goenoeng Talamau, north-west slope, 2050 m., epiphytic in forest. (H. A. B. BÜNNEMEIJER n. 788, May 1617); west slope, 2700 m. (H. A. B. BÜNNEMEIJER n. 856, May 1917).

PFITZER would place this in his subgenus *Aphanostelidium*. It is apparently near *D. glossorhynchum* SCHLTR., but with much larger flowers, broadly ovate bracts, an erose lip with a relatively broader midlobe.

In n. 788 the column was nearly entire, whereas in n. 856, the flowers of which had already set fruit, it was provided with a tooth on each side of the clinandrium.

In the form of the lip the species much resembles *D. cornutum* BL.

The flowers are said to be light green or green.

Description from herbarium and flowers preserved in alcohol.

Dendrochilum (sect. Platyclinis) **appendiculatum** J. J. S. n. sp.

Rhizoma valde ramosum, initio vaginis tubulosis imbricantibus acutis sicco dense prominenter nervosis opacis maculis obsoletis obscurius punctatis notatis infra pseudobulbos accrescentibus ad c. 5 cm. longis tectum. Pseudobulbi dense aggregati, elongato-ovoidei, apicem versus attenuati, sicco ad c. 3 cm. longi, 0.8 cm. diam. Folium lineari-lanceolatum, c. 1—3.75 cm. infra apicem plus minusve contractum, deinde sensim angustatum, breviter conduplicato-acutum vel anguste obtusum, interdum plus minusve apiculatum, basi acutum, nervis c. 5—7 majoribus subtus tenuiter prominentibus, nervis numerosis tenuibus interpositis, sicco tenuiter papyraceum, semipellucidum, c. 14.5—21 cm. longum, 0.95—1.4 cm. latum; petiolus tenuis, canaliculatus, c. 2.2—4 cm. longus. Inflorescentia in pseudobulbo immaturo folio fere

evoluto synantha, laxe multiflora, pedunculo filiformi, c. 12—17.5 cm. longo, rachide leviter flexuosa, lateraliter compresso-quadrangula, lateribus angustis canaliculata, glabra, c. 12.5—15 cm. longa, internodiis c. 0.35—0.4 cm. longis. Bracteae patentissimae, breviter ovato-triangulae, obtusae, breviter apiculatae, basi utrinque rotundatae, c. 7nerviae, bene 0.3 cm. longae, 0.35 cm. latae. Flores patentes, parvi. Sepalum dorsale oblongo-ovatum, apicem recurvulum versus angustatum, obtusiusculum, concavum, marginibus convexum, 3nervium, c. 0.4 cm. longum, 0.175 cm. latum. Sepala lateralia oblique oblongo-ovata, acuta, leviter canaliculata cum lateribus convexis, apice recurvula, 3nervia, nervis exterioribus interdum subobsoletis, fere 0.4 cm. longa, 0.17 cm. lata. Petala oblique oblonga, acuta, basi margine antico in lobulum parvum rotundatum dilatata, superne papillosa, 3nervia, nervis exterioribus tenuissimis, c. 0.325 cm. longa, 0.14 cm. lata. Labellum latum, 3lobum, valde convexum, basi tantum leviter concavum, nervis 3 subtus inferne convexo-incrassatis, intus lamellis 2 remotis altis aliformibus basi lata rotundatis subsemicordatisque adscendentibus superne decrescentibus in lobo medio abrupte deminutis et sensim evanescentibus bene supra basin costa transversa postice paulum producta et decumbente conjunctis appendicem magnam concavam hypochylio aequilatam formantibus, callo parvo erecto longitudinali lateraliter compresso subsemiorbiculari in medio hypochylii, explanatum c. 0.325 cm. longum; lobi laterales rotundati, integerrimi, concavi, hypochylium transverse oblongum c. 0.1 cm. longum 0.225 cm. latum formantes; lobus intermedius marginibus apiceque valde recurvus, apice leviter canaliculatus, a lobis lateralibus sinibus acutis separatus, late quinquangulari-rhombeus, utrinque rotundatus, apice subrectangulus, longe et dense papillosus, c. 0.225 cm. longus, 0.26 cm. latus. Gynostemium brevissimum, curvatum, dorso convexum, c. 0.13 cm. longum, alis lateralibus e medio gynostemii, parvis, patentibus, oblique linearibus, apice oblique retusis, ala apicali bene brevioribus, ala apicali suborbiculari, dentata, concava, pede brevissimo. Anthera patentissima, cucullata, cordata, apicem versus angustata, apice recurvulo truncata, c. 0.075 cm. longa, connectivo convexo-gibboso, basin versus incrassato. Pollinia 4, geminata, anguste clavata, obtusa, cum caudiculis tenuibus basi curvatis c. 0.075 cm. longa. Rostellum patens, recurvum, semiorbiculari-triangulum, apiculatum, canaliculatum cum lateribus convexis et costa longitudinali convexa in canalicula. Stigma transverse subreniformi-ovale, margine inferiore rotundatum elevatumque. Ovarium breve, obconicum, apice obliquum, 6sulcatum, cum pedicello brevi crasso c. 0.17 cm. longum. Capsula brevissime pedicellata, patens, rachidi adpressa, oblique ovali-obovoidea, sexangulato-cylindrica, taeniolis 3 longitudinalibus anguste linearibus canaliculatis, c. 0.6 cm. longa, 0.43 cm. diam.

Sumatra: Padangsche Bovenlanden, Goenoeng Merapi, 1400 m. and 1800 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 4930 and 4982, September 1918).

Apparently near *D. barbifrons* PFITZ. but with crowded and shorter pseudobulbs, narrower leaves, differently coloured flowers, the sepals and petals not acuminate, a threelobed lip and the side wings of the column linear not subulate.

„Flowers salmon-coloured, fragrant." (BÜNNEMEIJER).

Description from herbarium only.

Dendrochilum (sect. Platyclinis) **lamellatum** J. J. S. n. sp.

Rhizoma elongatum, teres, c. 0.3 cm. diam., vaginis imbricantibus tubulosis acutis apice carinatis dense nervosis coriaceis punctatis infra pseudobulbos accrescentibus ad c. 6—7 cm. longis obtectum. Pseudobulbi c. 2.7 cm. dissiti, rhizoma continui, cauliformes, tenues, teretes, apicem versus vix attenuati, apice oblique in gibbum obtusum producti, c. 5—8 cm. longi, 0.5—0.6 cm. diam. Folium erectum, lineari-lanceolatum, conduplicato-acutum, basi in petiolum brevem contractum, 5nervium, costa media supra sulcata subtus obtuse prominente, coriaceum, supra nitidum, subtus opacum, c. 16—17.5 cm. longum, 1.8—1.7 cm. latum; petiolus canaliculatus, c. 1.2—1.3 cm. longus. Inflorescentiae in pseudobulbis fere maturis, nutantes, densius multiflorae, pedunculo tenuiter filiformi, c. 11.5 cm. longo, rachide valde torta, quadrangula, lateribus valde canaliculata, furfuraceo-punctata, c. 11.5 cm. longa, internodiis c. 0.3 cm. longis. Bracteae patentes, ovarium pedicellatum amplectentes, late orbiculari-ovatae, c. 0.6 cm. longae, 0.75 cm. latae. Flores torsione quaquaversi, patentes, mediocres, bene expansi, bene 0.8 cm. lati, sepalis patentissimis, convexis, dorso furfuraceo-punctatis. Sepalum dorsale late ovato-ovale, obtusum, 3nervium, c. 0.5 cm. longum, 0.37 cm. latum. Sepala lateralia late oblique ovata, obtusa, basi concava, 3nervia, nervo brevissimo utrinque addito, c. 0.55 cm. longa, 0.38 cm. lata. Pelata patentia, oblique subobovato-ovalia, late angulato-rotundata cum apiculo parvo obtuso, superne erosula, concava, superne convexa, 3nervia, c. 0.425 cm. longa, bene 0.3 cm. lata. Labellum valde concavum, utrique gynostemio adpressum, obsolete 3lobum, subtus convexum et basi sulcis 3 longitudinalibus manifeste 4costatum, 5nervium, intus superne praeter marginem utrinque convexo-incrassatum, incrassationibus apicem versus angustatis, lamella transversa horizontali apice obtuse trilobulata cavum antice apertum septis 3 iongitudinalibus verticalibus cum nervis 3 conjunctis alte bicameratum formante supra basin, lamella aequilonga alta longitudinali marginibus labelli incurvis horizontali irregulariter marginata basi tantum cum lamella transversa conjuncta utrinque supra basin in nervis exterioribus, c. 0.4 cm. longum et latum, explanatum subsemiorbiculare, c. 0.4 cm. longum, 0.55 cm. latum, lobis lateralibus rotundatis, denticulatis, vix a lobo intermedio semiorbiculari apice plicis subtrilobulato irregulariter marginato sejunctis. Gynostemium breve, dorso convexum, apicem versus cuneato-alatum, c. 0.175 cm. longum, 0.18 cm. latum, alis lateralibus dentem brevem patentem oblique triangulum acutiusculum in utraque stigmatis parte

formantibus, clinandrio convaco, margine postico aequilateraliter trapeziformi late retuso, pede brevi. Anthera non abscondita, cucullata, ovata, obtusa, c. 0.1 cm. lata, connectivo alte obtuse conico. Pollinia 4, obovato-ovalia, caudiculis aequilongis filiformibus clavata, c. 0.1 cm. longa. Rostellum conspicuum, antheram bene aequans, ovatum, apice brevissime contractum truncatum et recurvulum, concavum. Stigma oblique suborbiculare, margine elevatum. Ovarium 6sulcatum, c. 0.2 cm. longum; pedicellus curvatus, c. 0.275 cm. longus.

Sumatra: West coast, Goenoeng Singgalang, 1700 m. (E. JACOBSON, cult. sub n. 1203).

An interesting species allied to *D. fuscescens* SCHTR. et J. J. S., characterized by the curious appendages of the almost entire lip.

„Peduncle, bracts and ovary dark sienna-brown, sepals and petals light sienna-brown darker at the tips, column greenish light sienna-brown, anther light sienna-brown." (E. JACOBSON).

Description from small portions of the plant preserved in alcohol.

Dendrochilum (sect. Platyclinis) **fruticicola** J. J. S. n. sp.

Rhizoma repens, ramosum, initio vaginis tubulosis imbricantibus sicco dense prominenter nervosis opacis atrofusce punctatis ad basin pseudobulborum accrescentibus superioribus acutis ad c. 4.5 cm. longis tectum, radicibus crassiusculis. Pseudobulbi approximati, usque c. 1 cm. dissiti, cum rhizomate angulum acutum facientes, sicco cylindracei, ovales vel ovoidei, c. 1.7—3.6 cm. longi. Folium lanceolatum ad elliptico-lanceolatum, apice contractum, subacutum vel subobtusum, apiculatum, basi acuta abrupte in petiolum contractum, nervis c. 7 majoribus et pluribus minoribus subtus in sicco prominentibus, coriaceum, c. 7.75—13 cm. longum, 1.6—2.9 cm. latum; petiolus canaliculatus, c. 2—4.5 cm. longum. Inflorescentia synantha, in pseudobulbo immaturo cum folio fere evoluto, laxa, pedunculo c. 4.5—12.5 cm. longo, rachide lateraliter compressa, quadrangula, lateribus angustis sulcata, inferne furfuracea, c. 7.25—11 cm. longa, internodiis c. 0.6—0.7 cm. longis. Bracteae persistentes, patentissimae, marginibus involutae, pedicellum amplectentes, subquinquangulari-obovatae, obtusae, minute apiculatae, basi late truncatae et utrinque in rachide decurrentes, 3nerviae, costa media dorso prominente, dorso atrofusce furfuraceo-punctatae, c. 0.575 cm. longae, 0.47 cm. latae, bractea inferiore plerumque sterilis et adpressa. Flores c. 10—16, magni. Sepalum dorsale incurvum, ovato-lanceolatum, acutum, canaliculato-concavum cum lateribus convexis, 3nervium, c. 1.2 cm. longum, 0.425 cm. latum. Sepala lateralia oblique ovato-lanceolata, acuta, obtusangule canaliculata cum lateribus convexis, 3nervia, c. 1.2 cm. longa, 0.4 cm. lata. Petala incurva, e basi contracta oblique ovata, subacuminata, acuta, concava, apice vix recurvulo convexa, 3nervia, fere 1.2 cm. longa, 0.46 cm. lata. Labellum elastice insertum, in c. $^1/_4$—$^1/_3$ parte supra basin obtusangule recurvum, marginibus,

exceptis in flexu ubi plicam formantibus, convexo-recurvis, costis 2 in lobo medio sensim decrescentibus apicem fere attingentibus, stria longitudinali et margine lobi intermedii pallidis exceptis brunneum (in spiritu vini), explanatum c. 0.95 cm. longum, hypochylio quadrangulo, basi rotundato-angustato, apice utrinque in dentem minimum acutum exeunte, margine minutissime denticulato, c. 0.3—0.35 cm. longo, 0.4—0.45 cm. lato, lobo intermedio convexo cum canaliculo inconspicuo, ovato, obtuso vel breviter acute triangulo-acuminato, erosulo, c. 0.6 - 0.65 cm. longo, 0.5 - 0.53 cm. lato. Gynostemium gracile, arcuatum, c. 0.46 cm. longum, alis lateralibus supra basin, subpatentissimis, valde incurvis, subtortis, linearibus, anguste obtusis, ala apicali conspicue brevioribus, ala apicali dilatata, apice recurvula truncata et plus minusve crenulato-denticulata, clinandrio concavo, filamento subulato, pede distincto, cum ovario angulum obtusum faciente, quadrangulo, truncato, 0.07 cm. longo. Anthera cucullata, ambitu breviter ovato-triangula, in rostrum breve triangulum obtusum convexum recurvulum acuminata, basi biloba, bene 0.1 cm. lata, connectivo basi alte et anguste obtuse gibboso. Pollinia 4, oblique obovata, extus convexa, intus plana. Rostellum conspicuum, patentissimum, gynostemio aequilatum, subsemiorbiculare, minute apiculatum. Stigma semiovale, margine elevatum, margine inferiore rotundatum. Ovarium obconicum, 6sulcatum, c. 0.23 cm. longum; pedicellus tenuior, c. 0.175 cm. longus.

Sumatra: West-coast, Goenoeng Singgalang, 2600 m., in brushwood. (H. A. B. BÜNNEMEIJER n. 2774, May 1918). Goenoeng Malintang, 2200 and 2250 m., in brushwood. (H. A. B. BÜNNEMEIJER nrs. 4214 and 4213, August 1918).

A distinct species with large flowers and an almost entire lip with very small dentiform sidelobes.

Description from herbarium and flowers preserved in alcohol.

The flowers are said to be light green or yellowish green, the lip for the greater part dark brown.

Dendrochilum (sect. Platyclinis) **insectiferum** J. J. S. nom. nov. — *Platyclinis insectifera* RIDL. in Journ. Fed. Mal. St. Mus. VIII (1917), 89.

Rhizoma ramosum, breve, vaginis deinde fatiscentibus tectum. Pseudobulbi c. 0.4—0.7 cm. distantes, sicco oblongi, apice attenuati, valde rugosi, c. 2.2—2.5 cm. longi, novelli vaginis tubulosis sese amplectentibus breviter acutis sicco dense prominenter nervosis atrofusce punctatis superioribus accrescentibus ad c. 3.5—4.5 cm. longis obtecti. Folium petiolatum, ellipticolanceolatum, apice longitudine 0.6—1.6 cm. manifeste triangulo-contractum, obtusum vel acutum, breviter apiculatum, basi acuta in petiolum angustatum, nervis c. 7 majoribus et numerosis tenuibus omnibus sicco subtus prominulis, coriaceo-papyraceum, c. 9—11.5 cm. longum, 2.5—4 cm. latum vel interdum minus; petiolus canaliculatus, c. 2.5 - 4 cm. longus. Inflorescentia

folio semievoluto synantha, laxe pauci-pluriflora, pedunculo tenui, c. 8.5 – 17 cm. longo, rachide leviter flexuosa, a latere compresso-quadrangula, lateribus angustis sulcata, parce muriculato-puberula, c. 5.5—7.5 cm. longa, internodiis c. 0.4—0.55 cm. longis. Bracteae convolutae, ovarium pedicellatum amplectentes at superantes, explanatae obovatae ad obovato-ellipticae, acutae, superne plus minusve dentatae, 3(—4)nerviae, dorso furfuraceae, c. 0.4 - 0.5 cm. longae, 0.35—0.375 cm. latae. Flores c. 9 – 14. Sepalum dorsale oblongo-ovatum, breviter apiculato-acuminatum, acutum, concavum, 3nervium, c. 0.875 cm. longum, 0.4 cm. latum. Sepala lateralia oblique ovata, acuta, apiculata, concava, 3nervia, costa media dorso prominente, c. 0.875 cm. longa, 0.45 cm. lata. Petala oblique subovato-oblonga, acuminata, acuta, concava, apice recurvula, dorso longitudinaliter sulcata, 3nervia, c. 0.68 cm. longa, 0.3 cm. lata. Labellum supra basin et apice recurvum, 3lobum, convexum, medio inconspicue canaliculatum, costis 2 basi satis conspicuis deinde sensim evanescentibus, 5nervium, nervis exterioribus brevibus, subtus longitudinaliter sulcatum, explanatum ambitu subovato-oblongum, basi latum, c. 0.58 cm. longum; lobi laterales brevissimi, basin versus rotundati, antice non producti, dentem inconspicuum obtusangulum formantes, subintegerrimi, hypochylium aequilateraliter trapeziforme c. 0.22 cm. longum 0.28 cm. latum facientes; lobus intermedius quinquangulari-rhombeus, acutus, $^3/_5$ partibus superioribus repandus, c. 0.36 cm. longus, medio 0.24 cm., basi 0.18 cm. latus. Gynostemium gracile, curvatum, c. 0.44 cm. longum, alis lateralibus conspicuis, cum gynostemio angulos acutos facientibus, basilaribus, oblique oblongis, basin versus paulo dilatatis, subulato-acuminatis, margine postico sigmoideis, margine antico infra subulam lobulum parvum rotundatum formantibus, usque basin gynostemii bene 0.3 cm. longis, ala apicali parvula, recurva, ovato-triangula, obtusa, antice convexa, dorso concava, pede abbreviato, truncato. Anthera cucullata, triangula, subacuta, connectivo basi conico-gibboso-incrassato antice decurrente, basi bilobulata, c. 0.075 cm. lata. Rostellum recurvum, e basi lata triangulum, acutum. Stigma longitudinale, oblongum, margine incrassatum. Ovarium 6sulcatum, c. 0.17 cm. longum, cum pedicello tenuiore 0.2 cm. longo angulum obtusum faciens.

Sumatra: West coast, Korintji Peak, 2200-2400 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER nrs. 9924, 10085 and 10236, May 1920).

I have no doubt that *Platyclinis insectifera* RIDL. is intended for this plant though the petals are not carinate.

From the dry specimens and the flowers preserved in alcohol the sepals appear to have been pale with two longitudinal brown bars except the base, the petals brown except the base, the lip brown with a pale longitudinal line, the column pale dotted brown in the upper part and with the stelidia brown for the greater part.

Description from herbarium and flowers preserved in alcohol.

Dendrochilum (sect. Platyclinis) **furfuraceum** J. J. S. n. sp.

Rhizoma ramosum, vaginatum. Pseudobulbi approximati, ad c. 1 cm. dissiti, crasse ovoidei, sicco c. 1.5—2.4 cm. longi, 0.8—1.7 cm. diam., initio vaginis imbricantibus sursum accrescentibus tubulosis acutis sicco dense prominenter nervosis opacis dense atrofurfuraceis ad c. 5.5—8 cm longis tecti. Folium lanceolatum, basi apiceque acutum, nervis c. 7 distinctis et pluribus minoribus in sicco subtus prominentibus, coriaceum, c. 6—18.5 cm. longum, 1.4—3.8 cm. latum; petiolus canaliculatus, c. 0.7—5.5 cm. longus. Inflorescentia in pseudobulbo immaturo, folio evoluto synantha, erecta, laxe multiflora, pedunculo validiusculo, furfuraceo-puberulo, c. 5—19.5 cm. longo, rachide lateraliter compresso-quadrangula, lateribus angustis sulcata, furfuraceo-puberula, c. 12—27 cm. longa, internodiis c. 0.4—0.65 cm. longis. Bracteae patentissimae, rachidem semiamplectentes, marginibus involutae, $^3/_4$ ellipticae, obtusae, breviter apiculatae, basi utrinque decurrentes, dorso furfuraceo-punctatae, c. 0.5 cm. longae. Flores mediocres, sepalis dorso parcissime furfuraceo-punctatis, intus parce minute muriculatis. Sepalum dorsale incurvum, ovato-oblongum, dimidio superiore angustatum, acutum, apiculatum, canaliculato-concavum cum lateribus convexis, margine recurvum, 3nervium, c. 0.7 cm. longum, 0.32 cm. latum. Sepala lateralia divergentia, oblique ovato-oblonga, acuta, apiculata, obtusangule canaliculata cum lateribus convexis, 3nervia, c. 0.67 cm. longa, 0.3 cm. lata. Petala incurva, oblique elliptica, breviter triangulo-acuminata, subacuta, basi subcontracta, concava cum lateribus convexis, intus extusque parce minute muriculata, suberosula, 3nervia, c. 0.6 cm. longa, 0.3 cm. lata. Labellum elastice affixum, supra basin rectangule recurvum, 3nervium, costis 2 parallelis supra basin transverse conjunctis in lobo medio sensim evanescentibus, costula tertia minore basi apiceque excepto sulcata interposita, totum explanatum c. 0.55 cm. longum, hypochylio majusculo, quadrangulo, basi rotundato-angustato, apice utrinque in dentem parvum patentem oblique triangulum acutum vix minutissime serrulatum dilatato, usque apicem loborum lateralium c. 0.23 cm. longo, ad loborum lateralium c. 0.27 cm., inferne 0.2 cm. lato, lobo intermedio ovato-rhombeo, acuto, basi excepta erosulo, convexo, medio leviter canaliculato, apice recurvo canaliculato, c. 0.33 cm. longo, fere 0.3 cm. lato. Gynostemium curvatum, dorso angulato-convexum, c. 0.43 cm., usque apicem alarum lateralium 0.3 cm. longum, alis lateralibus infra medium totius longitudinis gynostemii, patentibus, incurvulis, ala terminali bene brevioribus lineari-subulatis, acutis, ala apicali porrecta, subquadrangula, apice angustata, truncata, dentata, convexa, filamento subulato, pede distincto, cum ovario angulum subrectum faciente, quadrangulo, truncato, c. 0.07 cm. longo. Anthera cucullata, ambitu ovato-triangula, apice triangulo recurcula, c. 0.1 cm. lata, connectivo basi obtuse conico-gibboso. Rostellum ovato-triangulum. Stigma semiovale, margine inferiore rotundato vix elevatum. Ovarium obconicum, 6sulcatum, c. 0.13 longum; pedicellus vix tenuior, c. 0.27 cm. longus.

Sumatra: Agam, Brani, 900 m., in the forest. (H. A. B. BÜNNEMEIJER n. 3333, June 1918).

A near ally of *D. longifolium* RCHB. F., but with shorter pseudobulbs, the sheaths densely dotted blackish, muriculate inflorescences and flowers, the lip with shorter side lobes.

"Flowers green". (BÜNNEMEIJER).

Description from very few dried specimens and flowers preserved in alcohol.

The material of n. 3438 is very poor. Here the lip is more oval and blunt.

Dendrochilum (sect. Platyclinis) **basale** J. J. S. n. sp.

Pseudobulbi ovoidei ad subglobosi, apice leviter contracti, c. 1—2 cm. longi, 0.95—0.8 cm. diam., initio vaginis imbricantibus tubulosis acutis dense prominenter nervosis atrofusce punctatis sursum accrescentibus ad c. 4.5 cm. longis tecti. Folium lanceolatum, apice contractum, acutum, basi acuta abrupte in petiolum contractum, supra in utraque parte costae mediae canaliculatae leviter convexum, coriaceum, c. 4.6—6.6 cm. longum, 0.95—1.8 cm. latum; petiolus canaliculatus, c. 1.2—1.9 cm. longus. Inflorescentia folio haud bene evoluto synantha, erecta, pedunculo filiformi, c. 9—9.5 cm. longo, rachide nutante, lateraliter compresso-quadrangula, funfuraceo-punctata, c. 7 cm. longa, internodiis c. 0.4—0.45 cm. longis. Bracteae patentissimae, marginibus involutae, late ellipticae, apice serrulatae, subobtusae, basi truncatae, furfuraceo-punctatae, 3nerviae, c. 0.47 cm. longae, 0.35 cm. latae, bractea infima sterilis. Flores c. 17, majusculi. Sepalum dorsale ovato-lanceolatum, apicem versus sensim angustatum et recurvulum, acutum, obtusangule concavum cum lateribus convexis, 3nervium, c. 1 cm. longum, 0.275 cm. latum. Sepala lateralia oblique ovato-lanceolata, apicem recurvulum versus sensim angustata, acuta vel subacuta, obtusangule canaliculata cum lateribus convexis, dorso carinata, 3nervia, c. 1 cm. longa, 0.3 cm. lata. Petala e basi unguiculato-contracta oblique ovata, leviter acuminata, acuta, basi apiceque excepto erosa, concava, 3nervia, c. 0.875 cm. longa, 0.34 cm. lata. Labellum elastice insertum, 3lobum, undatum. supra basin obtusangule recurvum, apice recurvum, 3nervium, costis 2 parallelis, supra basin costula transversa conjunctis, superne sensim evanescentibus, canaliculo usque ad apicem labelli producto separatis, explanatum c. 0.625 cm., usque apicem loborum lateralium c. 0.2 cm. longum, hypochylio ambitu subsemiorbiculari, antice in lobos laterales erecto-patentes oblique triangulos acutos convexos serrulatos producto; lobus intermedius e basi aequilateraliter trapeziformi c. 0.08 cm. longa basi 0.25 cm. lata ovatus, subacuminatus, subacutus vel subobtusus, eroso-repandulus, totus c. 0.47 cm. longus, 0.32 cm. latus. Gynostemium gracile, curvatum, sectione transversa triangulum, c. 0.375 cm. longum, alis lateralibus basilaribus, longis, gynostemio conspicue brevioribus,

porrectis, paulo divergentibus, incurvulis, oblique linearibus, superne angustatis, subacutis, c. 0.16 cm. longis, ala apicali recurvula, porrecta, subquadrangula, medio paulo dilatata, apice late subtruncata, irregulariter retusa, convexa, antice leviter canaliculata, dorso carinata, clinandrio concavo, filamento subulato, pede distincto, cum ovario angulum obtusum faciente, apice incurvo obtusissimo, c. 0.075 cm. longo. Anthera cucullata, triangula, apice acuto recurva, c. 0.07 cm. lata, connectivo in dimidio inferiore valde oblique obtuse gibboso. Rostellum patentissimum, subovatum, obtusum, convexum cum incrassatione convexa longitudinali. Stigma longitudinale, subovale, margine inferiore rotundatum vix elevatum. Ovarium breviter obconicum, 6sulcatum, c. 0.1 longum; pedicellus paulo tenuior, c. 0.14 cm. longus.

Sumatra: Benkoelen, Goenoeng Dempoe, 2000 m. (Exp. E. JACOBSON, AJOEB n. 449, August 1916).

This is evidently near *D. linearifolium* HOOK. F., but differs according to the description and plate in the much broader acute leaves contracted at the apex, densely furfuraceous bracts and sheaths, broad blunt bracts, much larger flowers, the lip with two keels and the larger apical wing of the column.

The native collector describes the colour as light yellow with a black lip.

Description from material preserved in alcohol.

Dendrochilum (sect. Platyclinis) **papillosum** J. J. S. n. sp.

Pseudobulbi approximati, elongati, sicco apicem versus attenuati, c. 5.725 cm. longi, initio vaginis imbricantibus nervosis opacis obscure punctatis superioribus accrescentibus ad c. 6.75 cm. longis inclusi. Folium latum, elliptico-lanceolatum, obtusum vel subobtusum, basi acuta in petiolum contractum, nervis c. 7—9 majoribus et numerosis tenuibus, c. 14—17 cm. longum, 4.3—3.6 cm. latum; petiolus canaliculatus, c. 1.85—3.2 cm. longus. Inflorescentia in pseudobulbo immaturo, folio evoluto synantha, pedunculo c. 12—17 cm. longo, rachide inconspicue flexuosa, lateraliter compresso-quadrangula, lateribus angustis canaliculata, internodiis c. 0.4—0.5 cm. longis. Bracteae patentissimae, marginibus involutae, acuminatae, acutae, dorso minute furfuraceo-punctatae, c. 0.43—0.46 cm. longae, 0.26 cm. latae, infima sterilis. Flores mediocres, sepalis petalisque incurvulis, basi intus crassius papilloso-puberulis. Sepalum dorsale oblongo-rhombeum, plus minusve quinquangulare, acutum, minute apiculatum, basi subcontractum canaliculatum cum lateribus convexis, 3nervium, c. 0.7 cm. longum, 0.26 cm. latum. Sepala lateralia oblique oblongo-ovata, subacuminato-angustata, acuta, minute apiculata, medio canaliculata cum lateribus convexis, 3nervia, c. 0.7 cm. longa, 0.275 cm. lata. Petala e basi unguiculato-contracta oblique oblongo-ovata, angustata, acuta, medio canaliculata, lateribus convexa, basi excepta erosula,

3nervia, c. 0.625 cm. longa, 0.23 cm. lata. Labellum mobile, undatum, supra basin obtusangule recurvum, apice abrupte recurvum, 3lobum, 3nervium, 3costatum, costis exterioribus in hypochylio altis, superne decrescentibus, in lamina lobi intermedii vix convexis et canalicula separatis, costa intermedia multo humiliore, fere usque apicem producta, basi triangulo-incrassata et cum costis exterioribus in incrassationem postice truncatam conjuncta, costulis 2 inconspicuis brevibus in flexu supra basin inter costas additis, c. 0.43 cm., explanatum 0.56 cm. longum; lobi laterales hypochylium satis longum ambitu oblongo-sexangulatum usque medium cuneatum et integerrimum deinde erosulum antice utrinque in laciniam longe subulatam patentem c. 0.125 cm. longam productum absque laciniis c. 0.2 cm. longum 0.16 cm. latum formantes; lobus intermedius late spathulatus, striis 2 brunneis notatus, ungue satis angusto, quadrangulo, c. 0.1 cm. longo et lato, lamina valde convexa, e basi cuneata angulato-suborbiculari, apice truncata cum apiculo minimo, c 0 25 cm. longa, 0.3 cm. lata. Gynostemium curvatum, dorso convexum, c. 0.4 cm. longum, alis lateralibus infra medium totius longitudinis, elongatis, patentibus, incurvulis, oblique linearibus, extus canaliculatis, intus angulato-convexis et superne carinatis, subacutis, ala apicali brevioribus, ala apicali majuscula, ambitu subelliptica, apice gradatim 4—5dentata et recurvula, subtus convexa, pede distincto. Anthera abscondita, cucullata, ambitu triangula, e basi lata in rostrum triangulum obtusum convexum producta, connectivo alte oblique conico-gibboso, basi bilobulata, c. 0.075 cm. lata. Rostellum triangulum, supra convexum. Stigma obverse triangulum, margine elevatum. Ovarium 6sulcatum, c. 0.1 cm. longum; pedicellus paulo tenuior, c. 0.125 cm. longus.

Sumatra: Padangsche Bovenlanden, Goenoeng Talang, Laras Talang, 1700 m., epiphytic in the forest. (H. A. B. BÜNNEMEIJER n. 5323, October 1918).

In the structure of the flower this much resembles *D. gracile* J. J. S, but the leaves are very much broader, the flowers larger and the column very different.

„Flowers light green, lip with two brown streaks." (BÜNNEMEIJER).

Description from one dried specimen and part of an inflorescence preserved in alcohol.

Dendrochilum (sect. Platyclinis) **liparidiflorum** J. J. S. n. sp.

Planta pusilla, caespitosa. Rhizoma valde ramosum, initio vaginis tubulosis acutis plus minusve apiculatis dense prominenter nervosis opacis praesertim superioribus punctatis infra pseudobulbum accrescentibus ad c. 2 cm. longis tectum. Pseudobulbi dense aggregati, fusiformes vel plus minusve ovoideo-oblongi, sicco c. 1.25—1.5 cm. longi, 0.33—0.45 cm. diam. Folium lanceolato-lineare, breviter acutum vel obtusum, apiculatum, basi

acuta sulpetiolato-contractum, nervis 3 majoribus et pluribus minoribus subtus prominentibus, costa media supra ad basin sulcata, papyraceum, c. 4.25—4.75 cm. longum, 0.3—0.4 cm. latum; petiolus canaliculatus, c. 0.75—1 cm. longus. Inflorescentia in pseudobulbo immaturo folio fere evoluto synantha, laxe pluriflora, pedunculo tenuiter filiformi, c. 2.9—3.25 cm. longo, rachide torta, leviter flexuosa, lateraliter compresso-quadrangula, c. 5—6 cm. longa, internodiis c. 0.35—0.375 cm. longis. Bracteae patentissimae, rhombeae, acutae, apiculatae, marginibus involutae, 1nerviae, parce punctatae, infima interdum sterilis, ad c. 0.4 cm. longae, 0.2 cm. latae. Flores c. 14, patentissimi, parvi, valde aperti, c. 0.4 cm. lati, 0.7 cm. longi. Sepalum dorsale infra medium incurvulum, apice recurvulum, subovato-oblongum, acutum, subulato-apiculatum, angulato-concavum cum lateribus convexis, 1nervium, c. 0.37 cm. longum, 0.125 cm. latum. Sepala lateralia deorsum spectantia, divergentia, oblique ovato-oblonga, acuminata, acuta, subulato-apiculata, obtusangule canaliculata cum lateribus convexis, costa media dorso prominente, nervo 1 tenui addito, c. 0.375 cm. longa, 0.13 cm. lata. Petala patentissima, incurvula, oblique sublinearia, supra basin vix contracta, breviter acuminata, vix erosula, leviter canaliculata cum lateribus convexis, costa media praesertim superne dorso prominente, 1nervia, bene 0.3 cm. longa, 0.075 cm. lata. Labellum a gynostemio patentissimum, cum gynostemio et ovario angulos subrectos faciens, 3lobum, supra basin obtusangule recurvum, callo carnoso transverso elliptico margine elevato margine postico stigmati arcte adpresso ad basin inter lobos laterales, lamella longitudinali semiovali rotundata extrorsum decumbente crassiuscula in utraque calli parte ad basin loborum lateralium, explanatum totum c. 0.27 cm. longum, 0.3 cm. ad lobos laterales latum; lobi laterales basilares, patentissimi, adscendentes, cum lobo intermedio angulum obtusum facientes, oblique trianguli, margine postico basi in lobulum rotundato-triangulum reversum dilatati, ceterum erosi, medio vel paulo supra medium obtusangule incurvi subulatique, c. 0.1 cm. longi, 0.06 cm. lati; lobus intermedius oblongus, ultra medium leviter dilatatus, deinde angustatus irregulariter marginatus et breviter acute apiculato-acuminatus, rectus, leviter convexus, apice recurvulus et canaliculatus, dorso concavus cum costa longitudinali, fere 0.25 cm. longus, 0.8 cm. latus. Gynostemium breve, latum, ambitu late ovatum, dorso obtusangule convexum, subtus concavum, 3lobum, c. 0.13 cm. longum, alis lateralibus in dimidio inferiore, patentibus, oblique rotundato-quadrangulis, margine antico ala apicali anguste obtectis, ala apicali bene brevioribus, ala apicali subsemiorbiculari, truncato-rotundata, integerrima, filamento triangulo, pede obsoleto. Anthera sub ala abscondita, cucullata, late ovato-triangula, apice leviter contracta, truncata, basi reverse bilobula, connectivo crasse gibboso, c. 0.06 cm. lata. Pollinia 4, geminata, pyriformi-clavata, caudiculis inaequilongis filiformibus, c. 0.05 cm. longa. Rostellum patens, subsemiorbiculare, apice recurvulum, incurvule apiculatum, medio canaliculatum. Stigma transversum, margine inferiore valde elevatum

subtruncatumque. Ovarium 6sulcatum, c. 0.125 cm. longum; pedicellus 0.2 cm. longus. Capsula patens, fusiformis, basi valde contractus, taeniolis 3 linearibus, cum basi contracta c. 0.1 cm. longa c. 0.85 longa, 0.35 cm. diam., pedicello 0.15 cm. longo.

Sumatra: Padangsche Bovenlanden, Goenoeng Talang, Laras Talang, 1700 m., epiphytic in the forest, (H. A. B. BÜNNEMEIJER n. 5235, October 1918).

A very interesting small species, the flowers of which look like those of a *Liparis* of the section *Platystylis*. Especially remarkable are the calli of the lip and the broad column.

„Inflorescence and flowers light violet". (BÜNNEMEIJER).

Description from herbarium and an inflorescence preserved in alcohol.

Dendrochilum (sect. Platyclinis) **pholidotoides** J. J. S. n. sp.

Rhizoma valde ramosum, teres, radicans, vaginis tubulosis acutis sicco superne prominenter nervosis opacis obscure punctatis ad c. 2.5 cm. longis, ramis patentibus. Pseudobulbi rhizoma continui, cum eo angulum acutum facientes, c. 1.2—1.6 cm. dissiti, sicco anguste ovoidei, c. 0.5—1.8 cm. longi, 1folii. Folium lanceolatum, breviter acutum, apiculatum, basi acuta sensim in petiolum angustatum, nervis majoribus c. 5 subtus in sicco prominentibus, nervis pluribus tenuibus interpositis, papyraceum, c. 6.25—8 cm. longum, 0.9—1.2 cm. latum; petiolus canaliculatus, c. 0.8—1 cm. longus. Inflorescentia in pseudobulbis immaturis, folio evoluto synantha, erecta, laxe multiflora, pedunculo tenui, c. 7.25—8.5 cm. longo, rachide flexuosa, a latere compresso-quadrangula, lateribus canaliculatis, parcissime muriculato-puberula, c. 6.5—7.5 cm. longa, internodiis c. 0.3—0.4 cm. longis. Bracteae persistentes, rachidem semiamplectentes, marginibus involutis pedicellum includentes, ovarium pedicellatum aequantes vel paulo breviores, semiovales, rotundatae, 5nerviae, c. 0.3 cm. longae, 0.37 cm. latae, 2 inferiores steriles adpressae. Flores parvi, patentissimi, c. 0.4 cm. lati, sepalis petalisque incurvis. Sepalum dorsale ovale, rotundatum, concavum, 3nervium, c. 0.325 cm. longum, 0.225 cm. latum. Sepala lateralia labello subtus adpressa, oblique ovata, obtusa, concava, 3nervia, c. 0.34 cm. longa, 0.225 cm. lata. Petala oblique subovalia, obtusa, basi lata sed medio tantum affixa, concava, basi excepta minute erosula, 2nervia, fere 0.3 cm. longa, 0.15 cm. lata. Labellum porrectum, immobile, sigmoideum, 3lobum, inferne valde subsaccato-concavum, 5nervium, ecallosum, explanatum c. 0.33 cm., usque apicem loborum lateralium 0.17 cm. longum; lobi laterales basilares, patentes, rotundati, antice in lobulum liberum parvum porrectum triangulum producti, basi excepta eroso-denticulati, hypochylium transverse oblongum basi breviter cuneato-angustatum c. 0.32 cm. latum formantes; lobus intermedius latissimus, valde revolutus, convexus, ambitu late et breviter triangulus, apice late rotundatus et in lobulum brevem rotundatum productus, basi truncatus, basi apiceque exceptis erosus, hypochylio latior,

c. 0.175 cm. longus, 0.4 cm. latus. Gynostemium breve, dorso convexum, utrinque infra stigma brachiolo subpatentissimo oblique lineari obtuso recto donatum, c. 0.2 cm. longum, clinandrii margine postico conspicuo, aequilateraliter trapeziformi, truncato, concavo, dorso convexo. Anthera cucullata, triangula, longe anguste obtuse acuminata, basi lobulato-truncata, bene 0.1 cm. longa, connectivo convexo-costulato. Rostellum magnum, porrectum, apicem clinandrii longe superans, triangulum, leviter acuminatum, anguste obtusum, concavum, supra subtusque costula longitudinali instructum. Stigma prominens, oblique cupuliforme, semiorbiculare, margine inferiore rotundato elevatum. Ovarium 6sulcatum, c. 0.1 cm. longum; pedicellus paulo tenuior, c. 0.25 cm. longus.

Sumatra: Padangsche Bovenlanden, Laras Talang, Boekit Niroe, 1600 m., in forest. (H. A. B. BÜNNEMEIJER n. 5574, November 1918).

A rather puzzling plant, which in some points is intermediate between *Pholidota* and *Dendrochilum*. In habit it resembles a small *Pholidota*, the inflorescence might be that of a *Dendrochilum*, in the very concave base of the lip without calli and in the form of the footless column especially that of the prominent rostellum and stigma it again is a *Pholidota*, but the erose side lobes of the lip and the small arms of the column suggest a *Dendrochilum*.

The flowers are described as very light green, but in the dried flowers there is a distinct oval brown band.

Description from herbarium material and an inflorescence preserved in alcohol.

Microstylis ternatensis J. J. S. n. sp.

Caulis erectus, 0.9 cm. longus, basi vaginatus, c. 5folius. Folia erecto-patentia, divergentia, oblique oblongo-elliptica, acuminata, acuta, basi in petiolum contracta, 5nervia, mediana c. 18—19 cm. longa, 5.5—6.25 cm. lata, inferiora et superiora minora; petiolus canaliculatus, cum vagina ad c. 5.5 cm. longus, superiores breviores. Inflorescentia laxius multiflora, diu flores gignens, pedunculo c. 13.5 cm. longo, vaginula bracteiformi instructo, rachide 23 cm. superante. Bracteae reflexae, subulatae, acutae, 1nerviae, ad c. 0.7 cm. longae. Flores mediocres. Sepalum dorsale oblongum, obtusum, convexum, 3nervium, bene 0.4 cm. longum, 0.2 cm. latum. Sepala lateralia oblique erecta, divergentia, oblique ovata, obtusa, convexa, 3nervia, c. 0.375 cm. longa, 0.14 cm. lata. Petala divergentia, oblique oblongo-spathulata, obtusa, leviter retusa, convexa, 1nervia, c. 0.35 cm. longa, 0.14 cm. lata. Labellum hippocrepidiforme, 3nervium, nervis exterioribus bene ramosis, basi lamella humili transversa basi gynostemii adpressa instructum, fovea lineari-oblonga utrinque fascia satis lata convexa limitata basin lobuli intermedii attingente, lobulo intermedio producto, incurvulo, concavo, ovato, basi lato, apice obtuso, breviter emarginato,

dentibus c. 4 manifeste brevioribus subaequilongis oblique anguste triangulis acutis utrinque, dentibus exterioribus latioribus et paulo brevioribus, auriculis remotis, divergentibus, triangulis, obtusis, explanatum c. 0.33 cm., cum auriculis c. 0.125 cm. longum, 0.5 cm. latum, lobulo intermedio c. 0.12 cm. longo, 0.16 cm. lato, auriculis margine interiore 0.25 cm. longis, basi 0.3 cm. latis. Gynostemium cum ovario angulum obtusum faciens (incurvum), a dorso compressum, oblongo-quandrangulum, apicem versus leviter dilatatum, c. 0.14 cm. longum, auriculis porrectis, parallelis, verticalibus, quandrangulis, obtusis vel plus minusve truncatis, antheram superantibus. Anthera plane cucullata, transverse ovali-reniformis, 0.07 cm. lata. Ovarium pedicellatum obtusangule curvatum, 6costulatum, 0.6 cm. longum.

Ternate: Toramadiahi, 650 m. (V. M. A. BEGUIN n. 1109, November 1920).

The nearest ally of this species seems to be *M. horielensis* J. J. S. from Ambon, from which it differs in the few leaves, the colour of the flowers, the fewer shorter and less unequal teeth of the lip.

„Leaves shining, flowers dirty yellow, crown (lip?) dark violet". (BEGUIN).

Description from one dried specimen.

Podochilus forficuloides J. J. S. n. sp.

Caules elongati, ramosi, repentes, radicantes, deinde adscendentes, tenuiter filiformes, internodiis c. 0.15 0.16 cm. longis. Folia parva, patentia, basi leviter torta, apice recurvula, lanceolata, acuta, longe filiformi-apiculata, 5nervia, praeter costam mediam canaliculata, ad c. 0.675 cm. longa, apiculo fere 0.1 cm. longo, 0.17 cm. lata; vaginae tubulosae. Inflorescentiae terminales, deinde ramulo novello pseudolaterales, brevissimae, c. 2 3florae, pedunculo cum rachide c. 0.15—0.2 cm. longo. Bracteae laxe adpressae, ovatae, longe acuminatae, acutissimae, concavae. Flores parvi, c. 0.325 cm. longi, ad sepala lateralia 0.175 cm. lati. Sepalum dorsale erectum, apice recurvulum, carnosulum, parte inferiore valde concavum et tenuius, triangulum, $^3/_5$ partibus superioribus contractum, obtusum, breviter conico-apiculatum, 1nervium, c. 0.2 cm. longum, 0.1 cm. latum. Sepala lateralia lacinia lata saccato-concava ad partem inferiorem pedis gynostemii decurrentia, marginibus anticis usque ad medium connata, mentum conspicuum ovario adpressum latum saccatum a dorso compressum antice canaliculo lato longitudinali bilobum apice subtruncatum c. 0.15 cm. longum et latum formantia, partibus liberis divergentia, oblique triangula, obtusa, minute apiculata, canaliculata, praesertim dorso medio carnosulo-incrassata, 1nervia, c. 0.16 cm., in toto 0.3 cm. longa, parte libera 0.1 cm. lata. Petala cum labello conniventia, oblique lanceolata, in $^1/_4$ parte supra basin obtusangule falcata, supra basin leviter contracta, acuta, apice paulo incrassata, concava, 1nervia, c. 0.13 cm. longa, 0.03 cm. lata. Labellum apici pedis gynostemii insertum, recurvulum, marginibus praesertim ad basin anguste incurvis, ovato-triangulum,

apicem versus sensim angustatum, acutum, intus incrassationibus 2 longitudinalibus convexis humilibus instructum, 3nervium, basi appendicibus 2 reversis divergentibus plus minusve incurvis linearibus subteretibus obtusis c. 0.07 cm. longis donatum, c. 0.16 cm., cum appendicibus c. 0.23 cm. longum, lamina 0.075 cm. lata. Gynostemium breve, 0.13 cm. longum, clinandrio alte excavato, filamento dentiformi, auriculis ad basin rostelli utrinque dentem formantibus. Anthera cucullata, triangula, apice altius tridentata, dente intermedio paulo longiore et angustiore, basi leviter exciso-truncata, connectivo leviter triangulo-gibboso, c. 0.08 cm. longa. Rostellum porrectum, triangulum, alte acute bidentatum. Stigma alte excavatum, suborbiculare. Pes gynostemii ovario adpressus, tenuis, linearis, inferne longitudine c. 0.14 cm. sepalis lateralibus adnatus, parte superiore (vel ungue labelli?) libera, sursum curva. Ovarium pedicellatum c. 0.175 cm. longum.

Sumatra: West coast, Korintji Peak, 1500—1700 m., epiphytical in forest, common. (H. A. B. BÜNNEMEIJER nrs. 8531, 8690, 8719, 8789, 8905, March 1920).

A distinct species allied to *P. tenuis* LNDL. and *P. serpyllifolius* LNDL. The flowers are purple with a white mentum.

Description from herbarium and inflorescences preserved in alcohol.

Appendicula Theunissenii J. J. S. n. sp.

Caules approximati, simplices, tenues, teretes, c. 23 cm. longi, bene 0.2 cm. diam., internodiis c. 0.7—0.9 cm. longis. Folia patentia, basi leviter torta, recurvula, linearia, apicem versus angustata, inaequaliter bidentata cum mucrone longiore interposito, inferne obtusangule canaliculata, costa media supra sulcata subtus prominente, nervo 1 conspicuo utrinque, papyracea, ad c. 6 cm. longa, 0.55 cm. lata; vaginae tubulosae, apice antice excisae, internodia bene superantes. Inflorescentiae terminales et e nodis superioribus, recurvulae, paulo ramosae, laxe pluriflorae, 2 cm. superantes, pedunculo c. 0.9 cm. longo, nonnullis vaginulis adpressis donato. Bracteae reflexae, ovatae, acutae, concavae, 3nerviae, ad c. 0.34 cm. longae, superiores minores et relative latiores. Flores c. 0.55 cm. longi, sepalis petalisque conniventibus. Sepalum dorsale ovarium fere continuum, oblongo-triangulum, obtusiusculum, concavum, 3nervium, c. 0.34 cm. longum, 0.2 cm. latum. Sepala lateralia lacinia oblique late quadrangulo-oblonga concava ad pedem gynostemii decurrentia, mentum reversum cum ovario angulum acutum faciens oblongo-ovale subcylindricum apice rotundatum c. 0.24 cm. longum formantia, margine antico libera, parte antica divergentia, oblique triangula, acuta, leviter apiculata, 3nervia, costa media dorso prominente, bene 0.3 cm., usque menti apicem 0.5 cm. longa, basi 0.34 cm. metientia. Petala parallela, oblique oblonga, apicem versus sensim paulum dilatata, obtusa, brevissime obtuse apiculata, apice suberosula, 1nervia, c. 0.3 cm. longa, 0.12 cm. lata. Labellum erectum, pedi gynostemii adpressum, recurvulum,

gynostemium bene superans, spathulatum, canaliculatum, appendice conduplicata anguste \/formi satis alta basi unguem paululum superante cruribus antice decurrente et ad basin laminae satis abrupte rotundato-terminante in basi, basi 5nervium, explanatum c. 0.55 cm. longum, ungue oblongo, c. 0.35 cm. longo, medio 0.16 cm. lato, lamina obreniformi, lobulis rotundatis sinu obtusangulo separatis minute crenulata, callo parvo infra sinum, 0.2 cm. longa, 0.275 cm. lata. Gynostemium ovarium continuum, rectum, dorso convexum, margine in utraque stigmatis parte in auriculam patentem rotundatam denticulo minimo instructam dilatatum, subtus medio ad basin convexo-incrassatum, c. 0.175 cm. longum, clinandrio excavato, subsemiorbiculari cum costula longitudinali. Anthera breviter cordata, breviter obtuse acuminata, utrinque dente breviore donata, basi leviter gibbosa, c. 0.08 cm. lata. Pollinia 6, inaequalia, oblique obovata, ad 0.03 cm. longa, stipite 0.06 cm. longo bipartito, laciniis oblique ellipticis. Rostellum e basi lata abrupte contractum, 2dentatum. Stigma angulato-subsemiorbiculare. Pes gynostemii cum ovario angulum acutum faciens, apice valde incurvus, late linearis, marginibus erectis canaliculatus cum costa longitudinali a gynostemio decurrente, c. 0.23 cm. longus. Ovarium cum pedicello c. 0.05 cm. longum, 6sulcatum.

Sumatra: West coast, Natal, Air Tagelang. (A. V. THEUNISSEN, cult. in hort. E. JACOBSON, Fort de Kock, n. 1525).

In some respects this species appears to be similar to *A. rupestris* RIDL. It differs, however, in the longer linear leaves and especially in the form of the lip, which is described by RIDLEY and SCHLECHTER as being ecallose.

In the form of the lip *A. Theunissenii* much resembles *A. torta* BL. and *A. babiensis* J. J. S., but it is totally different in habit.

„Terrestrial. Bracts green with transparent margins. Ovary and pedicel light green sometimes tinged with brownish purple, with a brownish purple ring at the top of the ovary. Sepals and petals transparently light green, the mentum white hardly tinged with greenish. Lip white. Column light green, the stigma bordered purple. Rostellum with 2 purple spots. Anther yellowish with a purple spot." (E. JACOBSON).

Description from a plant preserved in alcohol.

Appendicula brevimentum J. J. S. in Bull. Jard. Bot. Buit. 3e sér. II (1920), 36.

Sumatra: West coast, Korintji Peak, 2000 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 9562, April 1920).

Though the material collected on Korintji Peak is very poor, it proves that the stems are branched.

The collector describes the flowers as white with two violet streaks on the petals.

Appendicula (sect. Fissanthera) **kinabaluensis** J. J. S. comb. nov. — *Chilopogon kinabaluense* AMES! Orch. VI (1920), 141.

A few particulars may be added to AMES' description.

The bracts are scattered not distichous as in the section *Chilopogon*. The mentum is inflated at the apex, contracted at the base. The lip has a broad very concave claw adnate to the column foot, the epichyl is not much broader, convex and possesses a longitudinal ridge. The anther is rounded with a rather deeply cordate base and a gibbous connective, produced at the apex into a conspicuous bifid beak narrower than the anther, with the lacinia nearly parallel and acute. There are 6 clavate pollinia very much narrowed towards the base, 2 much shorter caudiculae and a single \/-shaped glandula. The rostellum is projecting and bidentate.

The plant belongs to the section *Fissanthera*. It is most nearly related to *A. floribunda* SCHLTR., which, however, seems to be a larger plant with much longer generally branched inflorescences, the mentum hardly inflated at the apex, a shorter claw to the lip and the teeth of the anther curved outward.

I think that *A. Merrillii* AMES belongs to the same affinity.

Arundina revoluta HOOK. F. Fl. Br. Ind. V (1890), 858; Ridl. Mat. Fl. Mal. Penins. I (1907), 124.

var. **borneensis** J. J. S. n. var.

Rhizoma valde ramosum. Caules ad c. 1.5 cm. dissiti, erecti, plus minusve debiles, teretes, post florescentiam plus minusve ramosi, ad c. 75 cm. longi, 0.45 cm. diam., internodiis ad c. 3 cm. longis, superioribus decrescentibus. Folia erecto-patentia, recurva, graminea, anguste linearia, apicem versus sensim angustata, oblique acuta vel saepe subulata, basi bene semiamplexicaulia, supra canaliculata cum lateribus convexis, costa media subtus obtuse prominente, nervo 1 majore supra sulcato utrinque, papyracea, supra vix nitidula, subtus opaca pallidiora nervis tantum obscurioribus, c. 14—17 cm. longa, 0.45—0.7 cm. lata; vaginae tubulosae, caulem omnino obtegentes, dilute virides, ad c. 0.45—0.5 cm. diam. Inflorescentia simplex, laxe multiflora, pedunculo nitide dilute viridi, c. 2—3.25 cm. longo, vagina foliacea donato, rachide dilute viridi, nitida, ad c. 13 cm. longa. Bracteae patentes, e basi tubulosa triangulae, plus minusve subulato-acuminatae, acutae, valde concavae, semipellucide virescenti-albidae, superne pallide flavo-virides, nitidae, c. 0.95—1.25 cm. longae, superiores minores. Flores parvuli, teneri, pallide purpurei, c. 4.3 cm. lati et longi, sepalis erecto-patentibus, recurvis, dorso nitidis. Sepalum dorsale lanceolatum, acuminatum, acutum, canaliculatum cum lateribus convexis, superne albidum, apice pallide viride, c. 3 cm. longum, 0.8 cm. latum. Sepala lateralia sub labello

porrecta, subparallela, oblique lanceolata, subulato-acuminata, acuta, valde angulato-canaliculata cum lateribus convexis, costa media subtus prominente, apice pallide viridia, c 3 cm. longa, 0.8 cm. lata. Petala porrecta, recurva, subspathulato-rhombea, apice leviter triangulo-contracta, brevissime acute acuminata, basi apiceque albida, c. 3.2 cm. longa, basi 0.15 cm., in $^3/_5$ partibus supra basin 1.3 cm. lata. Labellum marginibus loborum lateralium incurvis contiguis tubulosum, gynostemium includens, apice valde recurvum et undulatum, subtrilobum, subtus sulcis 2 longitudinalibus instructum, intus 3costatum, costis exterioribus altioribus supra basin altissimis et in dentem reversum falcatum crenulatum exeuntibus basi crenulatis deinde leviter rugulosis in basi lobi intermedii crispatis crenulatisque deinde sensim evanescentibus papillosisque, costa intermedia multo minore sed apice quam exteriores magis conspicua et papillosa, intus papillosum, subtus albidum, intus fascia mediana usque sinum lobi intermedii alba longitudinaliter purpuree striolata et punctata, explanatum c 3.4 cm., usque apicem loborum lateralium 2.35 cm. longum, ad lobos laterales 2.55 cm. latum; lobi laterales incurvi, a lobo intermedio sinu tantum sejuncti, antice rotundati et undulati, dilute purpurei, explanati hypochylium e basi subrotundata obverse triangulum formantes; lobus intermedius valde recurvus, semiovalis, rotundatus, breviuscule rotundato-bilobus cum apiculo conico albo in sinu, valde undulatus, fascia mediana excepta purpureus, c. 1.45 cm. longus, 1.7 cm. latus, lobulis c. 0.45 cm. longis. Gynostemium gracile, vix curvulum, album, dorso versus apicem purpureo-suffusum, subtus subtiliter longitudinaliter purpureo-striolatum, c. 1.6 cm. longum, apice 0.33 cm. latum, clinandrio quadrato, praesertim medio alte excavato, margine eroso, margine postico bidentato, auriculis late triangulis, interdum emarginatis, erosulis. Anthera cucullata, apice dilatata et submembranaceo-producta, late rotundata emarginataque, basi bilobula, alba, c. 0.22 cm. lata. Pollinia 8, inaequalia, a latere compressa, pallide flava, oblonga, 2 postica minima trapeziformia. Rostellum magnum, convexum, plicis conspicuis 3lobulum, album, gynostemio aequilatum. Stigma parvum, sub rostello recurvo absconditum, alte excavatum, margine inferiore elevato, recurvo, aequilateraliter trapeziformi, 2dentato. Ovarium 6sulcatum, pallide viridi-flavum, facie soli exposita purpureo-suffusum, c. 1.65 cm. longum. Capsula subcylindrico-oblonga, facie inferiore subapplanata, valde 6costata, apice obtusa et floris reliquiis coronata, basi abrupte in pedicellum contracta, c. 2.7 cm. longa, 0.75 cm. diam., rimis 6 in valvas lineares basi apiceque connatas dehiscens, pedicello c. 0.7 cm. longo.

Borneo: In the Western part. (O. GRAVENHORST, liv. pl. cult. in Hort. J. J. SMITH). Soengei Ikang. (Exp. A. W. NIEUWENHUIS 1896–'97, JAHERI n. 1185).

A. revoluta HOOK F. was apparently described from living specimens, the colour of the flowers being given rather fully. If so the variety described

above should be raised to specific rank, as the leaves or the margins of the leaves are not revolute but in a dried state. Another disparity is found in the colour. HOOKER describes the lip as yellow within, RIDLEY with a pale yellow blotch, whereas in my plant there is no trace of that colour to be found on the labellum.

As far as I have seen the species I think that just the yellow blotch on the lip is one of the easiest characteristics to separate the species of this difficult genus. But in the first place very full descriptions are wanted.

In the young flower the midlobe of the lip is recurved. Afterwards it is more or less curved upwards with the sides deflexed as in *A. bambusifolia* LNDL.

Description from a living plant.

Calanthe (sect. Styloglossum) **aureiflora** J. J. S. n. sp.

Pseudobulbi ad c. 2.5 cm. distantes, parvi, c. 3—5folii, nonnulis vaginis ad c. 16 cm. longis ad basin. Folia lanceolata, sensim longius acuminata, acuta, basi sensim in petiolum angustata, glabra, nervis majoribus c. 7 subtus prominentibus, ad c. 21—50 cm. longa, 2.9—6.2 cm. lata; petiolus canaliculatus, costatus, cum vagina c. 10—30 cm. longus. Inflorescentia axillaris, erecta, dense multiflora, pedunculo c. 26—55 cm. longo, vaginis c. 7—8 tubulosis superne fissis persistentibus donato, rachide obtuse angulata, c. 1.2—5 cm. longa. Bracteae caducae, lanceolatae, sensim longius acutissime acuminatae, superne obtusangule incurvae, valde concavae, c. 5nerviae, minores c. 1.9 cm. longae. Flores pulvinis inserti, quaquaversi. Sepalum dorsale subobovato-ovale, apice longius subulato-apiculatum, et canaliculatum, concavum, basi leviter convexum, 3- sub5nervium, totum c. 1.3 cm. longum, 0.6 cm. latum, apiculo 0.15 cm. longo. Sepala lateralia oblique subobovato-oblonga, basi obliqua basin calcaris amplectentia, in subulam longiusculam canaliculatam acuminata, 3- sub5nervia, tota c. 1.3 cm., margine antico 1.45 cm. longa, 0.6 cm lata, apiculo 0.14 cm. longo. Petala e basi cuneato-unguiculata subovalia, late obtusa, abrupte subulato-apiculata, concava, dorso longitudinaliter sulcata, 3nervia, c. 1.3 cm. longa, fere 0.6 cm. lata. Labellum 3lobum, calcaratum, totum c. 2.3 cm. longum, parte gynostemio adnata c. 0.63 cm. longa, tubum bene lateraliter compressum antice bene altiorem et oblique truncatum subtus sulcatum et leviter sigmoideum apice c. 0.5 cm. altum formante; lamina porrecta, subtus sulcata, c. 0.75 cm. longa, ad lobos laterales 0.675 cm. lata, lamellis 2 altis longitudinalibus parallelis lateraliter compressis semiovalibus rotundatis basin lobi intermedii attingentibus inter lobos laterales; lobi laterales patentissimi, oblique ovato-trianguli, margine postico rotundati, margine antico subrecti, obtusi, convexi; lobus intermedius porrectus, suborbicularis, apice rotundato-bilobus cum apiculo recurvo in sinu, convexus, 3costulatus, costula intermedia inter lamellas basilares decurrente, c. 0.475 cm. longus, 0.6 cm latus; calcar reversum, cum labello angulum obtusum, cum ovario angulum acutum

faciens, vix sigmoideum, clavatum, c. $^1/_3$ parte apicali inflatum et leviter a dorso compressum, obtusum, leviter retusum, subtus sulcatum, c. 1.1 cm. longum. Gynostemium alis latis ungui labelli adnatum, tubum superans, leviter sigmoideum, dorso infra antheram rotundato-gibbosum, c. 0,8 cm. longum, clinandrio excavato, apice trilobulo-denticulato, auriculis breviter triangulis, extus convexis. Anthera cucullata, ovato-orbicularis, obtusa cum apiculo minuto recurvo, connectivo costulam convexam praesertim basin versus incrassatam formante, c. 0.18 cm. lata. Pollinia 8, paulum inaequalia, oblique pyriformi-clavata. Stigma semilunatum. Ovarium 6sulcatum, c. 0.85 cm. longum; pedicellus multo tenuior, c. 1 cm. longus.

Sumatra: West coast, Goenoeng Malintang, 1600 m., in forest. (H. A. B. BÜNNEMEIJER n. 3947, July 1918). As quoted, 1800 m. (H. A. B. BÜNNEMEIJER n. 4116, July 1918, fruiting). As quoted, 2000 m., in underbrush. (H A. B. BÜNNEMEIJER n. 4254, August 1918). Goenoeng Sago, 2000 m., in underbrush. (H. A. B. BÜNNEMEIJER n. 4363, August 1918, peloric flowers).

This seems to be near *C. albo-lutea* RIDL. but the plant is much smaller, with yellow flowers, the sepals and petals are not ovate and the lip has blunt side-lobes, a nearly orbicular midlobe and a slightly curved spur.

The flowers of n. 4363 are peloric with the lip free from the clavate column, and similar to the petals.

Description from herbarium and flowers preserved in alcohol.

Calanthe (sect. Styloglossum) **clavicalcar** J. J. S. n. sp.

Rhizoma breve, radicibus crassis, villosis. Pseudobulbi approximati, parvi, basi foliorum omnino obtecti, c. 4folii, nonnullis vaginis ad c. 8 cm longis ad basin. Folia erecta, petiolata, anguste lanceolata, longissime et anguste angustata, basi acuta, glabra, nervis majoribus c. 5 subtus prominentibus, nervis tenuibus numerosis interpositis, ad c. 42—45 cm. longa, 4.8 3.7 cm. lata; petiolus canaliculatus, costatus, cum vagina ad c. 20 cm. longus. Inflorescentia 1, erecta, c. 20flora, pedunculo (partim adest) vaginis tubulosis acutis donato, rachide angulata, glabra, c. 6 cm. longa. Bracteae caducae, lanceolatae, acutissime acuminatae, concavae, 5nerviae, 1.1 cm. vel plus longae. Flores patentes. Sepalum dorsale ellipticum, brevissime acute canaliculato-apiculato-acuminatum, basi latum, concavum, 5—7nervium, c. 1.25—1.45 cm. longum, 0.675—0.825 cm. latum. Sepala lateralia recurvula, basin calcaris amplectentia, oblique oblonga, breviter ad longe subulato-acuminata, concava, c. 7nervia, c. 1.2—1.55 cm. longa, 0.55—0.6 cm. lata. Petala e basi unguiculata oblique elliptica, obtusa acuta vel breviter vel longe apiculato-acuminata, concava, dorso longitudinaliter sulcata, 3nervia, c. 1.2—1.3 cm. longa, 0.7—0.65 cm. lata. Labellum 3lobum, calcaratum, c. 1.8—2.1 cm. longum, parte gynostemio adnata canaliculata c. 0.6 cm.

longa; lamina obtusangule recurva, costis 2 parallelis brevibus convexis ad basin inter lobos laterales, explanata c. 0.6—0.75 cm. longa, ad lobos laterales c. 0.6 cm. lata; lobi laterales patentes, apice plus minusve recurvi, breves, oblique late rotundato-trianguli vel rotundato-subquadranguli, basi lati, plus minusve irregulariter marginati, convexi; lobus intermedius cum lobis lateralibus angulos obtusos faciens, rectangule oblongus, apice truncato-rotundatus, brevissime vel conspicue apiculatus, 3nervius, c. 0.4—0.47 cm. longus, 0.25 cm. latus; calcar reversum, cum ovario angulum acutum, cum ungue labelli angulum obtusum faciens, clavatum, leviter lateraliter compressum, apice plus minusve recurvum, obtusum, c. 1.1—1.2 cm. longum. Gynostemium tota longitudine ungui labelli in formam tubi lateraliter compressi adnatum, dorso convexum, apicem versus incrassatum, cum rostello c. 0.775—0.85 cm. longum, clinandrio concavo, apice late rotundato denticulatoque, auriculis distinctis, dentatis. Anthera cucullata, ovata, longe acuminato-angustata, acuta, basi cordata, connectivo inter thecas convexo-costato, c. 0.35 cm. longa. Pollinia 8, inaequalia, clavata, lateraliter compressa, apice rotundata, cum glandula elongata angusta c. 0.45 cm. longa Rostellum cum gynostemio angulum obtusum faciens, e basi triangulo-dilatata longissime subulatum, gynostemium superans. Ovarium 6sulcatum, c. 0.9—1.2 cm. longum; pedicellus tenuior, c. 1.2—1.4 cm. longus.

Sumatra: L. Koto, Boekit Tinggi near Mangani, 1100 m., in the forest. (H. A. B. BÜNNEMEIJER n. 2997, June 1918). Brani, 900 m., in forest. (H. A. B. BÜNNEMEIJER n. 3328, June 1918).

Allied to *C. aurantiaca* RIDL., but according to the short description differing in the larger flowers, the petals not being broader than the sepals, the lip with two convex not semiovate keels, the clubbed spur.

N. 2997 is represented only by an abnormal specimen, the inflorescence being terminal.

The flowers are described as orange.

Description from herbarium and flowers preserved in alcohol.

Calanthe (sect. Eucalanthe) **veratrifolia** R. BR. in Bot. Reg. IX (1823), t. 270; etc.

var. **dupliciloba** J. J. S. n. var.

Flores minores, albi. Labelli calcar ovario pedicellato multo brevius; lamina ad basin callis flavis ornata, callis muriciformibus quam in typo numerosioribus antepositis; lobi laterales laciniis lobi intermedii bene breviores, bilobulati, lobulo postico brevissimo, lobulo antico oblongo; lobus intermedius cuneatus, bipartitus, laciniis angustis, oblique oblongis, deinde pallide auranticacus.

Ceram: Amahei, Goenoeng Laimo. (L. M. R. RUTTEN, liv. pl. cult. in Hort. Bog. sub. n. 124).

A number of plants were sent to the Buitenzorg Gardens and showed all the same characteristics.

The variety differs chiefly from the form with a short spur and narrow side-lobes in the small flowers, the bilobed side-lobes and more numerous calli at the base of the lip.

Description from living plants.

Calanthe (sect. Eucalanthe) **transiens** J. J. S. n. sp.

Folia petiolata, lanceolata, acute acuminata, basi sensim in petiolum angustata, glabra, nervis c. 7(—9) majoribus subtus prominentibus, sicco membranacea, c. 28—41 cm. longa, 6.5—9 cm. lata; petiolus canaliculatus, costatus, cum vagina c. 13—17 cm. longus. Inflorescentiae erectae, densius multiflorae, pedunculo puberulo, c. 62—64 cm. longo, vaginulis c. 3 puberulis ad c. 4 cm. longis donato, rachide brevissime puberula, c. 14 cm. longa. Bracteae elongatae, anguste ovato-lanceolatae ad lanceolato-lineares, apicem versus angustatae brevissime puberulae, ad c. 3.5—4.75 cm. longae, basi 0.8 cm. latae. Flores mediocres, sepalis dorso brevissime puberulis. Sepalum dorsale oblongo-ellipticum, acuminatum, apice canaliculato recurvulum, basi 3- supra basin 5nervium, c. 1.75 cm. longum, 0.75 cm. latum. Sepala lateralia oblique oblongo-elliptica, falcatula, apice canaliculato recurvula, obtusa cum apiculo subulato, basi 3- supra basin 5nervia, c. 1.8 cm. longa, 0.8 cm. lata. Petala oblique oblongo-elliptica, breviter obtuse concavo-apiculata et recurvula, 3nervia, c. 1.6 cm. longa, 0.67 cm. lata. Labellum inferne gynostemio tota longitudine adnatum, calcaratum, ungue pilis raris instructo, lamina alte tripartita, seriebus 3 verrucarum basi connatarum inter lobos laterales, seriebus exterioribus basi quam intermedia altioribus, intermedia plus minusve in lobum intermedium producta, explanata c. 1.7 cm. longa, ad lobos laterales 2.1 cm. lata, lobis lateralibus basilaribus, patentibus, oblique oblongis, acutatis vel subacuminatis, basi satis latis, margine antico rotundatis, c. 0.95 cm. longis, 0.5—0.575 cm. latis, lobo intermedio cuneato-spathulato, usque $^2/_3$ partes infra apicem vel minus bilobo, c. 1.15 cm. longo, basi 0.325 cm., superne bene 1 cm. lato, lobulis divergentibus, oblique ovalibus ad oblongis, rotundatis vel subtruncatis, antice crenulatis, c. 0.5—0.55 cm. longis, 0.5 cm. latis, calcari reverso, recto, clavato, obtuso, parce puberulo, c. 1.4 cm. longo. Gynostemium tota longitudine basi labelli adnatum, basi contractum, oblique obconicum, margine inferiore vix curvulum, dorso sigmoideum, parce puberulum, c. 0.6 cm. longum, clinandrio alte excavato, lobulo apicali rotundato, lobulis stigmaticis antheram bene superantibus, oblique subquadrangulis, angulo postico obtusis, extus convexis. Anthera alte cucullata, a dorso compressa, semiorbicularis, antice anguste membranaceo-marginata et in rostrum recurvulum abrupte contracta, bene 0.2 cm. lata. Pollinia 8, inaequalia, clavata. Ovarium 6sulcatum, c. 1 cm. longum, cum pedicello 2.1 cm. longo brevissime puberulum.

Sumatra: West coast, Korintji Peak, 2100—2400 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 9661 pp., 9747 pp., 9895 pp., 9901 pp., 10469 pp. (only flowers in alcohol; I suppose that this really belongs to n. 9747), April and May 1920).

This seems to be a somewhat variable plant, if indeed all the numbers cited above belong here.

It differs from *C. Ceciliae* RCHB. F. in the long bracts, the divided midlobe of the lip with longer rows of warts, and the short clavate spur not widened at the base, from *C. longibracteata* RIDL. in the narrower segments of the lip, the rows of warts at the base of the lip, the clubshaped spur, from *C. veratrifolia* R. BR. in the long bracts, the less divided midlobe, the longer rows of warts at the base of the lip, the puberulous column.

N. 9901 differs in the midlobe being narrower at the base and its lobes partly covering one another. In n. 10469 the series of warts are hardly produced on the base of the midlobe.

As all the numbers were mixed the colour of the flowers remains doubtful.

It might be an intermediate form between *C. longibracteata* RIDL. and *C. crumenata* RIDL. More exact observations are desirable.

Description from herbarium and flowers preserved in alcohol (n. 9747 only).

Amblyglottis pilosa DE VR. ex LNDL. (Folia Orch. Cal. (1854), 11) = *Preptanthe villosa* RCHB. F. in Bonpl. V (1857, 42) is, as the figure in the Leiden Herbarium shows, **Calanthe vestita** WALL. var. **sumatrana** SCHLTR., and *C. sumatrana* BL. ex BOERL. (in Midden-Sumatra IV (1884), 33, t. V) is, I suppose, **C Ceciliae** RCHB. F.

Eulophia bicolor BL. Fl. Jav. Orch. (1858), 153, t. 62; MIQ. Fl. Ind. Bat. III (1855), 62.

var. **celebica** J. J. S. n. var.

Pseudobulbi approximati, valde oblique depressi, ovales ad oblongi, carnosi, c. 6.5—7.5 cm. longi, 3.2—4.8 cm. lati, basi vaginati, c. 6folii, internodiis valde obliquis, radicibus crassis. Folia erecta, plus minusve recurva, lanceolata, acute acuminata, basi in petiolum latum canaliculatum angulatum inferne in vaginam tubulosam vergente angustata, longitudinaliter plicata, nervis c. 9—11 subtus prominentibus, firmiter herbacea, viridia, intermedia maxima, summa angustissima, ad c. 36—45 cm. longa, 10—55 cm. lata. Inflorescentia ex innovationum vaginae inferioris axilla, foliis valde juvenilibus synantha, erecta, laxe multiflora, pedunculo tereti, dilute viridi, c. 31 cm. longo, vaginulis c. 3—4 basi tubulosis ad c. 4—5.5 cm. longis donato, rachide elongata, dilute viridi, c. 31 cm. longa. Bracteae laxe adpressae, triangulo-lineares, acutae, concavae, dilute virides, ad c. 2.3 cm. longae, 0.5 cm. latae, superiores minores.

Flores sensim florentes, vagi, patentissimi, mediocres, leviter odorati, sepalis secundis, subparallelis, viridibus, apice intus sordide violaceo-suffusis, intus ad basin violaceo-notatis. Sepalum dorsale ovarium continuum, petalis adpressum, lineari-lanceolatum, apice marginibus incurvis breviter subacuminatum, canaliculato-concavum, nervis 5 dorso praesertim ad basin prominentibus, c. 1.65—1.9 cm. longum, 0.4 cm. latum. Sepala lateralia basi pedis gynostemii adnata, supra basin \/-formiter adscendentia, basi angulum acutum facientia, divergentia, oblique lineari-lanceolata, breviter acuminata, angulato-concava, dorso carinata, c. 1.75—2 cm. longa, 0.4—0.45 cm. lata. Petala sub sepalo dorsali porrecta, parallela, basi obliqua ad pedem gynostemii decurrentia, oblique oblonga, obtusa, concava, nervis praesertim intermedio dorso prominulis, pallide viridia, basi vix purpurea, margine postico c. 1.4—1.7 cm. longa, 0.64 - 0.72 cm. lata. Labellum basi ungue brevi cuneato apici pedis gynostemii in formam calcaris brevis conici paulum a dorso compressi c. 0.4 cm. longi adnatum, arcuatum, leviter trilobum, concavum, pallide viride, subtus basi apiceque exceptis fascia mediana longitudinali alba ornatum, in lobo medio intus macula alba donato, nervis 9 inter lobos laterales parallelis intermedio excepto bene ramosis elevatis, 5 medianis inter lobos laterales nitidis sordide dilute purpureis in lobo intermedio flabellato-ramosis colore lobi sed apicem versus sordide violaceo-suffusis, nervis in lobis lateralibus nitidis obscurius sordide violaceis, inexplanatum c. 1.85 cm. longum, explanatum ambitu e basi breviter cuneata oblongo-ovale, c. 2.15 cm. longum, lobis lateralibus basi latissimis, leviter rotundatis, hypochylium c. 1.45 cm. longum 1.325 cm. latum formantibus, lobo intermedio sinibus inconspicuis a lobis lateralibus sejuncto, transverse ovali, rotundato vel leviter retuso, laxe undulato, c. 0.7 cm. longo, 1.3 cm. lato. Gynostemium gracile, superne obtusangule incurvum, apice clinandrii recurvulum, superne vix incrassatum, dorso convexum, subtus concavum, pallide viride, basin versus virescenti-albidum, apice excepto purpureo-puncticulatum, absque anthera 0.8 cm. longum, clinandrio triangulo, apice producto. Anthera conspicua, cucullata, transverse subrhombea, apice latissimo medio in rostrum breve obtuse bilobulum convexum producta, thecis convexis, pallide flavescens, apice purpurascenti-suffusa, dorso in gibbum maximum reversum cum anthera angulum obtusum facientem oblongo-quadrangulum vel plus minusve ovalem retusum antice convexum cum canaliculo longitundinali dorso concavum violaceum basin versus pallidiorem anthera angustiorem 0.14 cm. latum producta, c. 0.25 cm. lata. Pollinia 2, a dorso compressa, triangula, angulis rotundata, dorso ad basin transverse fissa, collateralia, continua, corpusculum transverse oblongo-ellipticum formantia, flava, cum stipite breviusculo lato subovato albo et glandula conspicua transversa semilunata alba c. 0.16 cm. longa, fere 0.2 cm. lata. Rostellum brevissimum. Stigma alte excavatum, marginibus incurvis triangulum. Pes gynostemii cum ovario angulum acutum faciens, vix sigmoideus, ambitu oblongo-rhombeus, concavus, dorso inferne basi sepalorum lateralium incrassatione /\formi viridi instructus (vel pes bicruris cum calcari

labelli inter crura inserto?), a parte superiore flavescenti-albida valde distinctus, c. 0.8 cm., usque ad apicem crurium 0.55 cm. longus. Ovarium pedicellatum tortum, 6sulcatum, viride, c. 1.75—2.4 cm. longum.

Celebes: Makasar. (Cult. in Hort. J. OOSTENBROEK, Makasar). Goenoeng Pasangmalambe. (Exp. L. VAN VUUREN, RACHMAT n. 964, December 1913).

The variety differs from BLUME's description and figure of the type from Timor in the blunt petals, the midlobe of the lip being as broad as the hypochyl, the colour of the lip and the triangular pollinia.

The description was drawn up from a single living specimen, which was purchased by Mr. J. OOSTENBROEK, Makasar, afterwards bought by Mr. J. SETH PAUL, who finally presented me with it.

RACHMAT n. 964 consist of two dried inflorescences.

Eria (sect. Mycaranthes) **obliterata** RCHB. F. in Bonpl. V (1857), 55; etc.; J. J. S. in Fl. Buit. VI, Orch. (1905), 391; Atlas Fig. CCXCVI; KRZL. in Pflanzenr. IV. 50. II. B. 21 (1911), 89.

var. **sumatrana** J. J. S. n. var.

Planta validior. Inflorescentiae ad fere 50 cm. longae. Flores majores, c. 0.75 cm. diam. Sepalum dorsale c. 0.35 cm. longum. Sepala lateralia 0.45 cm. longa, 0.35 cm. lata. Petala 0.375 cm. longa, 0.13 cm. lata. Labellum explanatum c. 0.6 cm. longum, 0.67 cm. latum; lobus intermedius porrectus, angustus, infra apicem lobulis 2 distinctis recurvulis trapeziformibus apice irregulariter dentatis albis atroviolaceo-maculatis instructus. Pes gynostemii ruber, bene 0.3 cm. longus. Ovarium pedicellatum purpurascens, c. 1.25 cm. longum.

Sumatra: Padangsche Bovenlanden, Agam, Boekit Batoe Banting. (E. JACOBSON, cult. sub n. 1133).

Korintji Peak, 1700 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 8909, March 1920).

This differs from the Javanese type principally in the robust habit, larger flowers and distinct lobules of the midlobe.

Description from a plant cultivated in Buitenzorg.

Eria (sect. Urostachya) **erosula** J. J. S. n. sp.

Caules approximati, satis longi, tenuiusculi, non clavati (sicco), c. 32—33.5 cm. longi, apice 1.5—6 cm. longo 6—7folii. Folia linearia, apicem versus angustata, acutiuscula, 7—9nervia cum nervis tenuibus interpositis, sicco coriacea, c. 29—20 cm. longa, 1.5—0.85 cm. lata (sicco), inferiora maxima; vaginae breves. Inflorescentiae e caulis parte foliata ortae, subsessiles vel breviter pedunculatae, densius multiflorae, c. 11—12 cm. longae,

rachide puberula. Bracteae reflexae, oblongae vel plus minusve quinquangulari-oblongae, dimidio superiore angustatae, interdum superne plus minusve dilatatae, acutae, superne minutissime denticulatae, concavae, 3nerviae, c. 0.475 cm. longae, 0.175 cm. latae. Flores patentissimi vel plus minusve reversi, c. 0.6 cm. lati, bene 0.9 cm. longi, sepalis dorso sparse stellato-puberulis. Sepalum dorsale erectum, cum ovario angulum obtusum faciens, ovatum, apice breviter contractum, obtusum, concavum, 3nervium, c. 0.38 cm. longum, 0.28 cm. latum. Sepala lateralia cum pede gynostemii mentum conspicuum cum ovario angulum acutum faciens dorso vix sigmoideum basi leviter constrictum apice rotundato-obtusum leviter retusum antice apertum c. 0.47 cm. longum inferne 0.275 cm. superne 0.34 cm. latum formantia, incurva, concava, inferne inflata, oblique late semiorbiculari-triangula, obtuse apiculata, 3nervia, c. 0.4 cm. longa, 0.6 cm. lata. Petala divergentia, apice recurvula, oblique ovata, apice contracta, acuta vel obtusa, convexa, 1nervia, c. 0.36 cm. longa, 0.24 cm. lata. Labellum erectum, basin gynostemii attingens, undatum, concavum, 3lobum, 3nervium, explanatum totum c. 0.475 cm. longum; lobi laterales basilares, lamella transversa ante basin lobi intermedii connexi, hypochylium concavum ambitu suborbiculare basi truncatum apice late retusum brevissime obtuse bilobulum crenulato-erosulum et apice tantum pedi gynostemii adpressum medio incrassatum c. 0.22 cm. longum fere 0.2 cm. latum facientes; lobus intermedius erectus, spathulatus, canaliculatus, apice 3lobulus, c. 0.3 cm. longus, ungue cuneato-oblongo, c. 0.125 cm. longo, apice bene 0.1 cm. lato, lamina valde dilatata, basi late cuneata et utrinque cum ungue angulum obtusum faciente, c. 0.2 cm. longa, 0.44 cm. lata, lobulis lateralibus erectis, subparallelis, convexis, explanatis divaricatis, oblique oblongo-quadrangulis, plus minusve rotundatis vel truncatis, erosodentatis, lobulo intermedio subaequilongo, obtusangule triangulo. Gynostemium brevissimum, dorso convexum, c. 0.13 cm. longum, clinandrio majusculo, excavato, pariete postico truncato. Athera cucullata, apice subaequilonge 3dentata, dentibus triangulis, exterioribus falcato-incurvis, acutis, intermedio latiore, connectivo convexo-incrassato, bene 0.1 cm. lata. Rostellum recurvulum. Stigma majusculum, transversum. Pes gynostemii cum ovario angulum acutum faciens, rectus, apice obtusangule incurvulus, linearis, intus convexus et dense puberulus, c. 0.42 cm. longus. Ovarium pedicellatum subclavatum, 6sulcatum, pubescens, c. 0.6 cm. longum.

Sumatra: West coast, Goenoeng Merapi, 1700—1900 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER nrs. 4902 and 4667, September 1918). Goenoeng Sago, 1900 m., epiphytical in forest H. A. B. BÜNNEMEIJER n. 4367, August 1918, „flowers darker or lighter violet, disagreeable odour").

This differs from *E. floribunda* LNDL. in the more numerous long and narrow leaves, the not truncate mentum, the side lobes of the lip being connate higher up, the broader midlobe erose on the edges and the columnfoot slightly bent forward at the apex.

In nrs. 4367 and 4667 the midlobe of the lip is less erose on the edges.

Description from herbarium and an inflorescence preserved in alcohol (n. 4902 only).

Eria (sect. Aeridostachya) **purpureocentrum** J. J. S. n. sp.

Pseudobulbi approximati, oblongo-ovoidei ad ovoidei, compressi, c. 3 cm. longi, 1.5–2 cm. lati, 2folii, vaginis c. 5 approximatis superioribus accrescentibus conduplicatis triangulis acutis pellucidis coriaceis pallide virescentibus majoribus articulatis ad c. 11 cm. longis ad basin. Folia erecta, divergentia, lorato-lanceolata, acuta, basi longe angustata, obtusangule concava, costa media supra sulcata subtus prominente, carnoso-coriacea, vix nitidule viridia, c. 26—28 cm. longa, 4.7—4.4 cm. lata. Inflorescentia ex axilla vaginae summae, dense multiflora, cylindrica, pedunculo pallide viridi, cinnamomee stellato-tomentoso, c. 10 cm. longo, pluribus vaginulis bracteiformibus adpressis minutis donato, rachide arcuata, tereti, longitudinaliter sulcata, indumento pedunculi, c. 10 cm. longa, cum floribus 2 cm. diam. Bracteae minutae, adpressae, triangulae, concavae, pallide virides, cinnamomee tomentosae. Flores parvi, quaquaversi, patentissimi, c. 0.425 cm. lati, 0.7 cm. longi, sepalis dorso cinnamomee basi magis purpuree stellato-tomentosis. Sepalum dorsale cum ovario angulum obtusum faciens, incurvum, valde concavum, late subovale, apice obtuse acutatum et glabrum, basi latum, fere 0.3 cm. longum, 0.2 cm. latum. Sepala lateralia lacinia oblique oblonga concava ad pedem gynostemii decurrentia, mentum longum cum ovario angulum acutum fere rectum faciens supra basin recurvum oblongum subcylindricum apice rotundatum infra apicem obselete constrictum c. 0.28 cm. longum formantia, antice divergentia, concava, oblique late triangula, margine postico rotundata, apice breviter anguste obtusa, albida, infra apicem purpurea, apice ultimo albida, usque apicem ovarii 0.25 cm. longa, margine antico 0.47 cm. metientia. Petala incurva, apice recurvula, basi leviter concava, oblique oblonga, falcatula, basin versus leviter dilatata, obtusa, albida, fere 0.3 cm. longa, 0.13 cm. lata. Labellum parallelum pedi gynostemii erectum, apice recurvum, basin gynostemii attingens, obsolete 3lobum, $^3/_5$ partibus inferioribus (lobis lateralibus) incurvis concavum, dorso convexum, ecarinatum, oblongum, magnam partem purpureum, albo-marginatum, explanatum bene 0.4 cm., usque ad apicem loborum lateralium fere 0.3 cm. latum, lobis lateralibus minimis antice obtusis, lobo intermedio recurvo, undulato, transverse subquadrangulo, angulis anticis rotundato, brevissime recurvo-triangulo-acuminato, c. 0.125 cm. longo, 0.18 cm. lato. Gynostemium brevissimum, cum ovario angulum obtusum faciens, dorso convexum, sordide purpureum, vix 0.1 cm. longum, clinandrio excavato, apice lato aequaliter obtuse 3dentato, auriculis latis bilobulis, lobulo postico longiore triangulo tenui albo, lobulo antico brevi obtuso carnoso atropurpureo. Anthera plane cucullata, obtusa, atropurpurea, pallide marginata. Stigma semilunatum. Pes gynostemii cum ovario angulum acutum fere rectum

faciens, supra basin recurvus, apice incurvus, linearis, carnosus, basi subplanus cum sulco longitudinali et subverruculosus, marginibus in $^1/_3$ infra apicem confluentibus et costam altam apicem versus mox decrescentem formantibus, basi albidus, apicem versus subcarneus, c. 0.3 cm. longus. Ovarium pedicellatum subclavatum, apice dense basin versus laxius purpuree stellato-tomentosum, c. 0.65 cm. longum. Capsula patentissima, subcylindrica, flore sicco coronata, basi acuta, c. 0.75—0.8 cm. longa, valvis 3 linearibus 3 angustissime linearibus dehiscens, pedicello tenui, 0.2 cm. longo.

Sumatra: Padangsche Bovenlanden, Agam, Soengei Djanih. (E. JACOBSON, Fort de Kock, cult. sub nrs. 998 and 999; also in Hort. Bog.). Without locality (W. GROENEVELDT, Fort de Kock, cult. sub n 1956). Laras Talang, Boekit Niroe, 1700 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 5347, with young fruits, October 1918).

The differences between the species of the section *Aeridostachya* are often not easy to define. They consist often in a different arrangement of the characteristics.

Description from a cultivated specimen and a dried fruiting raceme.

Eria (sect. Hymeneria) **petiolata** J. J. S. n. sp.

Pseudobulbi subglobosi ad turbunati, pauci(2-)nodi, nitidi, virides, sordide violaceo-suffusi, c. 1—1.85 cm. longi, 1.3—1.7 cm. diam., 1—2folii, novelli nonnullis vaginis mox fatiscentibus et nervis in formam striarum pallidiarum relinquentibus tecti. Folia erecta, petiolata, lanceolata, apice inaequaliter rotundato-biloba erosulaque, basi acuta, acute marginata, supra in utraque parte costae mediae supra sulcatae subtus non prominentis convexa, crasse carnosa, nitidule atroviridia, subtus opaca et pallida cum stria longitudinali saturate viridi, c. 4.5—6 cm. longa, 1.85—2.4 cm. lata; petiolus canaliculatus, c. 0.5—1 cm. longus. Inflorescentiae pone folia, patentes, laxe multiflorae, folia superantes, pedunculo c. 1.8 cm. longo, dilute viridi, vaginulis 2 bracteis similibus donato, rachide pallide virridi, cum pedunculo pilis partim decoloribus partim pallide fuscescentibus parce pubescenti, c. 7 cm. longa. Bracteae reflexae, basi convexae, superne concavae, cum canaliculo longitudinali, oblongo-quinquangulares, obtusissimae, angulis erosulae, nervis 5 majoribus et 4 minoribus, semipellucidae, flavescenti-albidae, ad c. 0.7 cm. longae, 0.47 cm. latae. Flores patentes, die dulce odorati, c. 0.7—0.8 cm. lati, sepalis dorso ad basin pallide fuscescenti-puberulis petalisque incurvis tenuibus semipellucide flavescenti-albidis. Sepalum dorsale oblongo-ovatum, obtusum, concavum, c. 0.56 cm. longum, 0.275 cm. latum. Sepala lateralia cum pede gynostemii mentum breve latum cum ovario angulum acutum faciens obtusum retusum dorso convexum c. 0.25 cm. longum formantia, oblique triangula, obtusangule falcata, anguste obtusa, concava, c. 0.55 cm. longa, basi 0.375 cm. lata. Petala oblique lanceolata, anguste obtusa, leviter concava, apice convexa, superne vix purpurascenti-suffusa, c. 0.54 cm.

longa, 0.175 cm. lata. Labellum oblique erectum, medio fere abrupte recurvum, 3lobum, costis 3 validis simplicibus in lobum intermedium pulvinato-convexo-incrassatum papillosum excurrentibus basi callo transverso connatis, flavescenti-album, basi dilute ochraceum, inexplanatum c. 0.3 cm. longum, explanatum ambitu cuneato-sexangulatum, c. 0.4 cm. usque apicem loborum lateralium 0.28 cm. longum, ad lobos laterales 0.35 cm. latum; lobi laterales parvi, erecti, margine antico recurvo valde convexi, subfalcato-trianguli, obtusi, 0.04 cm. longi; lobus intermedius magnus, recurvus, ambitu transverse subsexangulatus, apice breviter rotundato-bilobulus cum lobulo minimo in sinu, c. 0.16 cm. longus, 0.26 cm. latus. Gynostemium cum ovario angulum obtusum faciens, dorso convexum, c. 0.175 cm. longum, subtus in utraque stigmatis parte macula pallide purpurea ornatum, clinandrio transverso, excavato, pariete postico late retuso cum lobulo brevi erosulo-denticulato utrinque, auriculis rotundatis, erosulo-denticulatis, concavis. Anthera cucullata, transversa, apice semiobiculari-producta incurvaque, flavescens, connectivo suborbiculari convexo-incrassato atropurpureo, c. 0.1 cm. lata. Pollinia 8, paulo inaequalia, pyriformia, semipellucide flavescentia. Stigma transverse ovale, margine inferiore elevatulo. Pes gynostemii cum ovario angulum acutum faciens, incurvulus, oblongus, marginibus parallelis, dorso convexus, apice truncatus, fere 0 2 cm. longus. Ovarium 6sulcatum, cum pedicello c. 0.9—1 cm. longum, dilute viride, indumento rachidis.

Sumatra: Lampong, Menggala. (H. A. GUSDORF, cult. in Hort. Bog. sub n. 152).

A small species of the *Hymeneria* section, resembling *E. ancorifera* J. J. S., but with 1—2 leaved pseudobulbs, blunt distinctly petioled leaves, more flowered inflorescences, very blunt bracts and different flowers.

Description from a cultivated specimen.

Dendrobium (sect. Grastidium) **sacculiferum** J. J. S. n. sp.

Rhizoma breve, repens, ramosum, radicibus crassis. Caules approximati, simplices, tenues, inferne subteretes, ceterum plus minusve compressi, duri, nitide virides, mox nudi, c. 75 cm. longi, 0.16 cm. lati, internodiis ad c. 1.8 cm. longis, superioribus brevioribus. Folia patentia, leviter torta, linearia, apicem versus angustata, valde oblique bidentata, basi semiamplexicaulia, costa media supra leviter sulcata subtus basin versus prominula, papyracea, nitidula, viridia, ad c. 10 cm. longa, 0.9 cm. lata; vaginae tubulosae, a latere compressae, apice truncatae, internodia superantes. Inflorescentiae vaginas 2 perforantes, patentes, brevissimae, 2florae, pedunculo abbreviato, compresso, pallide viridi, nonnullis vaginulis a latere compressis obtecto. Bracteae parvae, adpressae, semiorbiculares, hyalinae, c. 0.6 cm. longae. Flores parvuli, ephemeri, odorem Vanillae exhalantes, c. 1.4 cm. lati, sepalis petalisque patentissimis apice recurvis convexis albis apice vix flavescentibus. Sepalum dorsale subovato-oblongum, basi paululum

dilatatum, apice angustatum, obtusum, c. 0.8 cm. longum, 0.36 cm. latum. Sepala lateralia ad pedem gynostemii decurrentia, oblique obtusangule triangulo-oblonga, basi antice sensim dilatata, apice angustata, obtusiuscula, c. 0.875 cm., margine antico 1.15 cm. longa, basi 0.55 cm. lata. Petala leviter spathulata, obtusa, 3nervia c. 0.825 cm. longa, 0.225 cm. lata. Labellum apici pedis gynostemii insertum, supra basin obtusangule recurvulum, 3lobum, costa 1 longitudinali basi validissima apicem versus decrescente infra apicem leviter pulvinato-terminante, explanatum c. 0.95 cm., usque apicem loborum lateralium fere 0.4 cm. longum; lobi laterales ad basin labelli, parvi, apice libero falcatulo-lineares, margine exteriore minute crenulati, c. 0.07 cm. longi, hypochylium ambitu suborbiculare magnam partem virescenti-album basi ochraceum c. 0.36 cm. latum formantes; lobus intermedius porrectus, longe unguiculatus, c. 0.625 cm. longus, ungue linearioblongo, medio vix contracto, dilute viridi, c. 0.36 cm. longo, basi apiceque fere 0.2 cm., medio 0.14 cm. lato, lamina valde dilatata, transverse oblonga, biloba, cum ungue angulos obtusos faciente, apice leviter late excisa cum apiculo minuto in sinu, virescenti-alba, medio dilute viridi, c 0.625 cm. lata, lobulis trapeziformibus, margine exteriore oblique rotundato-truncatis erosulo-repandulis, c. 0.23—0.25 cm. latis. Gynostemium longiusculum, rectum, pallide viride, apice albidum, c. 0.4 cm. longum, clinandrio alte excavato, truncato, irregulariter marginato. Anthera cucullata, antice visa transverse subovali-semiorbicularis, apice truncata, basi gibbosa, dilute viridis, margine membranaceo hyalino, c. 0.14 cm. lata. Pollinia 4, pallide flava, supra convexa, subtus subplana, interiora quam exteriora paulo longiora et angustiora, bene 0.1 cm. longa. Stigma magnum, alte excavatum, obovatum, basi longe acuta in pedem gynostemii decurrens. Pes gynostemii cum ovario angulum acutum cum gynostemio angulum obtusum faciens, $^3/_4$ partibus inferioribus subrectus, dimidio inferiore dilute viridis, dimidio superiore flavo-brunneus, saccatus, apicem versus angustatus et canaliculatus, marginibus erectis basi rotundatis, parte incurva a sepalis lateralibus liber, c. 0.32 cm. longus. Ovarium obconicum, apice obliquum, 6sulcatum, pallide viride, furfuraceo-punctatum, c. 0.25 cm. longum; pedicellus elongatus, tenuis, virescenti-albus, c. 1,6 cm. longus.

Ternate. (V. M. A. BEGUIN, liv. pl. cult. in Hort. Bog. sub n. 43).

A very distinct species with the columnfoot excavate saccate.
Description from a living plant.

Dendrobium (sect. Oxystophyllum) **Hagerupii** J. J. S. n. sp.

Rhizoma ramosum, radicibus tenuibus. Caules compressi, dense foliati, c. 18—23 cm. longi, cum foliis c. 2—2.3 cm. lati, internodiis c. 0.85—1 cm. longis. Folia erecto-patentia, contigua, articulata, lateraliter compressa, oblique triangula, apicem versus angustata, subacuta vel obtusa, apiculata, basi rotundata, basi supra fissa, carnosa, margine superiore c. 2—2.3 cm.,

margine inferiore 2.7—3 cm., apice non fisso 0.7—0.9 cm. longa, basi 0.9—1 cm. metientia, supra basin 0.75—0.85 cm. lata, ultima decrescentia; vaginae tubulosae, lateraliter conpressae. Inflorescentiae axillares et ad apicem caulium, nutantes, deinde ramosae et capituliformes, pedunculo curvato, c. 1 cm. longo, omnino vaginulis adpressis imbricatis late ovato-triangulis acutis apiculatis concavis dorso carinatis superioribus accrescentibus dense obtecto. Bracteae vaginulis similes, latae, apiculatae. Flores carnosi, fere 1.1 cm. longi (macerati), sepalis petalisque parallelis, apice recurvulis. Sepalum dorsale oblongum, obtusum, dorso ad apicem leviter incrassatum, concavum, superne leviter convexum, 3nervium, c. 0.7 cm. longum, 0.3 cm. latum. Sepala lateralia cum pede gynostemii mentum breviusculum cum ovario angulum fere rectum faciens dorse valde curvatum convexum obtusum c. 0.42 cm. longum formantia, oblique triangula, obtusa, basi rotundata, concava, 3nervia, c. 0.7 cm., margine antico 0.8 cm. longa, basi 0.63 cm. lata. Petala oblonga, rotundata, basi breviter angustata, dorso obtusangule convexa, 1nervia, bene 0.5 cm. longa, 0.2 cm. lata. Labellum erecto-patens, leviter undatum, oblongum, subtus convexum, dimidio inferiore fere basin versus paulum angustato, basi truncato, medio canaliculato, glabro, marginibus latis velutino-papilloso, dimidio superiore verruculoso-pulvinato et pilis brevibus clavatis dense vestito, marginibus lateralibus recurvulo, apice rotundato, incrassatione levi transversa convexa antice excavatione suborbiculari limitata a parte inferiore separato, subtus ad apicem callo conspicuo conico acuto instructo, totum explanatum c. 0.7 cm. longum, basi 0.18 cm., superne 0.34 cm. latum. Gynostemium ovarium continuum, c. 0.225 cm. longum, clinandrio excavato, filamento subulato, auriculas parallelas rotundatas concavas bene superante. Anthera cucullata, ambitu subsexangulato-obovata, apice excisa, c. 0.14 cm. lata. Pes gynostemii cum ovario angulum acutum fere rectum faciens, valde incurvus, oblongus, marginibus parallelis, concavus, crasse carnosus, c. 0.425 cm. longus. Ovarium obconicum, apice valde obliquum, leviter 6sulcatum, c. 0.2 cm. longum.

Sumatra: Bataklanden, Toba, 1450 m. (O. HAGERUP n. 29, 1916—'17).

This differs from *D. tropidoneuron* SCHLTR. in the longer sepals not or indistinctly apiculate and without prominent veins, the shorter mentum and the large callus of the lip, from *D. deliense* SCHLTR. in the shorter leaves, the sepals not being apiculate, the proportionally short mentum, and from *D. minutigibbum* J. J. S. in the longer sepals, short mentum and large callus of the lip.

The indumentum of the apical portion of the lip appears at first sight to be caused by a fungus.

The colour of the flowers seems to have been dark red.

Description from dried specimens.

Dendrobium (sect. Ceratobium) **Dammerboerii** J. J. S. n. sp.

Rhizoma validum, repens, cylindricum, brevinode, viride, infra caules c. 1.7 cm. diam., vaginis mox evanescentibus. Caules validi, c. 4 cm. dissiti, nitide flavo-virides, c. 0.8—1.5 m. longi, inferne longitudine c. 7—11 cm. tenuiusculi, teretes, c. 0.9—1.15 cm. diam., deinde fusiformi-incrassati, parte incrassata c. 14—15 cm. longa, 2.2—2 cm. diam., ceterum apicem versus sensim attenuati et sectione transversa late elliptici, foliati, inferne vaginati, internodiis ad c. 4.5—5.75 cm. longis. Folia patentia, ovato-oblonga ad lanceolata, apicem versus sensim angustata, apice recurvula, oblique 2dentata, basi brevissime contracta semiamplexicaulia, concava, subtus convexa, nervis 5 supra sulcatis subtus non prominentibus, carnosa, novella nitide viridia, adulta magis opaca, subtus subopaca, c. 14.5—16.5 cm. longa, 4.75—4 cm. lata, superiora decrescentia; vaginae tubulosae, internodiis aequilongae vel paulo breviores, opace dilute virides. Inflorescentiae e nodis superioribus caulium adultorum, patentes, laxe pluriflorae, pedunculo tereti, valde sordide atroviolaceo-brunnee suffuso, c. 8 cm. longo. 0.24 cm. diam., vaginulis c 3 brevibus tubulosis obtusis, rachide subflexuosa, tereti, colore pedunculi, c. 21.5 cm. longa. Bracteae tubulosae, breviter subacutae, pallide virides, ad c. 0.65 cm. longae. Flores c. 8, quaquaversi, c. 0.7 cm. supra nodum in pulvino inserti, patentes, mediocres, carnosuli, suaveolentes, c. 2.8—3 cm. lati, 4.8 – 5 cm. longi. Sepalum dorsale erectum, supra basin ad dextram recurvum, valde tortum et undulatum, lineare, acutum, apiculatum, canaliculatum, opacum, pallide flavescens, basi excepta margine et striis 5 sordide atrofusco-violaceis confluentibus notatum, explanatum c. 2.9 cm. longum, basi 0.63 cm. latum. Sepala lateralia lacinia triangula deinde angustissima et cum ungue labelli connata ad pedem gynostemii decurrentia, mentum reversum levissime sigmoideum cum ovario angulum acutum faciens conicum superne longitudine c. 0.5 cm. attenuatum et calcariforme obtusum c. 1 cm. longum formantia, patentissima, plus minusve recurva, linearia, acuta, canaliculata, torta et valde undulata, colore sepali intermedii sed striis 7, c. 2.65 cm. longa, basi absque parte angustissima c. 0.83 cm., medio bene 0.6 cm. lata. Petala reflexa, oblique erecta, in dorso sepali intermedii decussata, recta, spathulato-linearia, apicem versus sensim dilatata, anguste obtusa, dorso infra apicem apiculata, valde torta, pallide flavescentia, striis 3 superne 7 sordide violaceis margine apicali excepto valde confluentibus, subopaca, c. 4.1 cm. longa, basi 0.175 cm , superne 0.625 cm. lata. Labellum ungue angusto dimidio superiori pedis gynostemii in formam calcaris tenuis adnatum, 3lobum, subrectum, leviter undatum, inter lobos laterales valde concavum, inexplanatum c. 2 25 cm. longum, costis 5 approximatis parallelis rectis ceraceis albis pulchre violacee praesertim inferne punctato-marginatis, costis 2 extioribus decumbentibus superne altioribus et in ungue lobi intermedii abrupte obtuse terminantibus, costis 2 sequentibus ad basin laminae abrupte obtuse alato-dilatatis et decumbentibus, deinde costis exterioribus similibus, in basi lobi intermedii altioribus, ante medium lobi intermedii profunde rotundato-excisis, antice lobum

erectum oblique semiovalem vel triangulum obtusum vel excisum formantibus, deinde sensim evanescentibus, costa intermedia ceteris simili sed fere in medio lobi intermedii rotundato-excisa, deinde in cristam altissimam 2 – 3dentatam ante apicem labelli abrupte terminantem elevata, explanatum totum c. 2.15 cm. longum, ad lobos laterales 1.47 cm. latum, ungue lineari, basin versus paulum angustato sordide violaceo, c 0.6 cm. longo, apice 0.2 cm lato, lamina basi late cuneata; lobi laterales erecti, concavi, gynostemium subaequantes, apice recurvi, oblique quadranguli, apice late subtruncato-rotundati, dilute ochracei, nervis ramosis elevatis violaceis praesertim marginem versus in punctos solutis; lobus intermedius porrectus, unguiculatus, totus fere 1 cm. longus, ungue oblongo, subtus concavo, albo, violaceo-marginato et punctato, c 0.35 cm. longo, 0.17 cm. lato, abrupte in laminam transverse oblongam subtrapeziformem apice abrupte acute subtriangulo-acuminatam et sigmoideam plus minusve sinuatam supra convexam subtus concavam et longitudinaliter canaliculatam albam paucis venis radiatis elevatis interrupte violaceis ornatam c. 0.6 cm. longam 0.95 cm. latam dilatato. Gynostemium rectum, sectione transverse triangulum, dorso ad apicem infra filamentum subgibbosum, subtus concavum, margine in utraque apicis stigmatis parte obtusangule dilatatum et dente minimo donatum, pallide flavescens, striis 3 longitudinalibus inconspicuis pallide violascentibus notatum et parce minute violaceo-puncticulatum, subtus album, minute atroviolaceo-punctatum, c. 0.67 cm. longum, clinandrio excavato, auriculis transverse subquadrangulis, obtuse bilobulis, citrinis. Anthera cucullata, antice plana, apicem versus leviter angustata, apice late rotundata et margine latiusculo albo-hirtella, citrina, medio parce rubro-punctata, c. 0.225 cm. lata. Pollinia 4, in corpuscula 2 oblique oblonga supra convexa unita, nitide flava, c. 0.13 cm. longa. Pes gynostemii cum ovario angulum acutum fere rectum faciens, $^{2}/_{5}$ partibus inferioribus rectus, latus, quadrangulus, concavus, albus, violaceo-punctatus, $^{3}/_{5}$ partibus superioribus ungui labelli adnatus, levissime curvulus, linearis, apicem versus angustatus, valde canaliculatus, atroviolaceus, c. 0.525 cm. longus, totus c. 0.97 cm. longus. Ovarium 6sulcatum, pallide virescens, inconspicue longitudinaliter sordide violaceo-striatum, c. 0.4 cm. longum; pedicellus teres, pallide virescens, c. 3.3 cm. longus.

Habitat? (Cult. in Hort. J. G. DAMMERBOER, Buitenzorg).
Halmaheira? (Cult. in Hort. Bog.).

The nearest ally of this species is *D. Strepsiceros* J. J. S. from the island of Batjan. It differs from the latter in the smaller differently coloured flowers, the petals being broader at the apex, the midlobe having a longer claw and not being warty inside, the 3 inner keels being much more conspicuous at their apex, the column not being appressed to the lip.

It is a pretty species with long lasting and fragrant flowers. The habitat Halmaheira is not wholly sure.

The plant cultivated in the Buitenzorg Gardens is a form with a somewhat longer midlobe of the lip.

Description from a cultivated plant.

Dendrobium (sect. Distichophyllum) **orbiculare** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIII (1914), 13. — *D. fusco-pilosum* A. et S.! in AMES Orch. VI (1920), 101.

The plant described by AMES and SCHWEINFURTH does not differ in any respect from *D. orbiculare*, only the flowers of the type appear to be a little smaller. Since the plant has been collected also in Banka.

Dendrobium (sect. Distichophyllum) **siberutense** J. J. S. n. sp.

Rhizoma repens, elongatum, ramosum, vaginatum, e nodis radicem crassam emittens. Caules c. 13.5 cm. distantes, rhizoma continui, simplices, c. 27—34 cm. longi, basi vaginati, ceterum foliati, internodiis inferioribus c. 3.5 cm. longis, superioribus ad c. 0.6 cm. reductis. Folia patentia, anguste lanceolata, apicem versus angustata, inaequaliter acute bidentata, sicco papyracea glaucescentia et dorso minute nigro-puncticulata, ad c. 7.75—8.5 cm. longa, 0.9—1.1 cm. lata, superiora decrescentia; vaginae tubulosae, internodia superantes, apice antice rotundato-excisae, truncatae, antice densius ceterum parce subadpresse grossius nigro-hirtae. Inflorescentiae e nodis, vaginas 2 perforantes, erecto-patentes, breves, 4—5florae, pedunculo c. 0.5—0.6 cm. longo, nonnullis vaginulis brevibus tubulosis donato, rachide flexuosa, c. 0.6—1 cm. longa. Bracteae persistentes, oblongo-triangulae, acutae, concavae, ad c. 0.45 cm. longae. Flores mediocres. Sepalum dorsale oblongum, apice angustatum, obtusum, longius recurvule apiculatum, infra medium vix constrictum, 5nervium, fere 1.1 cm longum, 0.475 cm. latum. Sepala lateralia lacinia oblique linereari ad pedem gynostemii decurrentia, margine antico breviter connata, mentum reversum anguste conicum obtusum c. 0.775 cm. longum formantia, oblique anguste oblonga, longe subulato-apiculata, 5nervia, c. 1.3 cm., usque apicem pedis gynostemii fere 2 cm. longa, 0.4 cm. lata. Petala oblique lineari-spathulata, vix falcatula, $^2/_3$ partibus superioribus erosa, obtusa, abrupte acute triangulo-apiculata, 3nervia, nervis exterioribus brevissimis, c. 1.15 cm. longa, inferne 0.16 cm., superne 0.23 cm. lata. Labellum ungue $^2/_3$ partibus pedis gynostemii adnatum, concavum, 3lobum, carnosulum, 3costatum, costis exterioribus infra basin lobi intermedii terminantibus dimidio inferiore in verrucas solutis ceterum glabris, costa intermedia brevi glabra infra basin lobi intermedii abrupte terminante in medio labelli, 5nervium, nervo intermedio in unguem decurrente, sequentibus e basi laminae ortis, explanatum totum c. 2.2 cm. longum, ungue lineari, c. 0.475 cm. longo, 0.18 cm. lato, mesochylio oblongo-sublyriformi, basi late obtuso, medio inconspicue constricto, apice in lobos laterales triangulos obtusos paucidenticulatos antice truncatos leviter dilatato,

basi intus dense verrucoso, superne seriebus 2 verrucarum costis approximatis et parallelis exceptis glabro, fere 1.1 cm. longo, medio 0.7 cm., antice 0.95 cm. lato, lobo intermedio ex ungue brevi fere 0.3 cm. lato abrupte dilatato, transverse oblongo, apice leviter et late exciso cum lobulo brevissimo obtuso in sinu, utrinque breviter lacerato, c. 0.65 cm. longo, bene 1.1 cm. lato. Gynostemium breve, a dorso compressum, ambitu quadrangulum, absque anthera 0.38 cm. longum, clinandrio transverso, auriculis triangulis, falcatulis, acutis, margine postico paucidenticulatis, filamento auriculis paulo breviore, lineari. Anthera cucullata, a latere visa triangula, antice visa quadrata, apice paulo producta truncata et hirtella, 0.23 cm. lata. Pollinia 4, sublinearia, supra convexa, subtus concava, antice attenuata, interiora quam exteriora paulo angustiora, c. 0.17 cm. longa. Stigma majusculum, margine inferiore rotundatum. Pes gynostemii parte superiore c. 0.5 cm. longa labelli ungui adnatus, apicem versus angustatus et intus incrassationibus 2 instructus, c. 0.7 cm. longus. Ovarium 6sulcatum, c. 0.65 cm. longum; pedicellus tenuior, 1.1 cm. longus.

Mentawei-Islands: Siberoet. (O. HAGERUP n. 42, February 1917).

From the description this appears to be near *D. Hosei* RIDL., but the sheaths are hairy, the petals erose except for the base, the lip much longer and narrower, warty inside and with blunt denticulate side lobes, the column not attenuate to the apex, the anther not ovate.

Description from herbarium.

Dendrobium (sect. Calcarifera) **pedicellatum** J. J. S. in Bull. Dép. Agric. Ind. Néerl. No. XV (1908), 13.

Caules elongati, c. 60 cm. longi, internodiis ad c. 5 cm. longis. Folia patentia, lanceolata, sensim acuminata, oblique acuta vel subacuta, nervis majoribus c. 5, c. 5.5–12.5 cm. longa, 1.2—3 cm. lata; vaginae tubulosae. Inflorescentiae 5—12florae.

Sumatra: Palembang, Goenoeng Dempoe, 2000 m. (Expedition E. JACOBSON, AJOEB n. 452, August 1916).

Padangsche Bovenlanden, Goenoeng Singgalang, 2500 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 2709 and 2860, May and June 1918). Goenoeng Malintang, 2000—2200 m, in brushwood. (H. A. B. BÜNNEMEIJER nrs. 3921, 3951, 4051, 4034 and 4221, July-August 1918). Goenoeng Sago, in forest and brushwood, 1800—2000 m., common. (H. A. B. BÜNNEMEIJER nrs. 3974, 3987 and 4358, July-August 1918). Laras Talang, Goenoeng Talang, 1900 m., in forest. (H. A. B. BÜNNEMEIJER n. 5374, November 1918). Laras Talang, Boekit Gombak, 2000 m., in forest. (H. A. B. BÜNNEMEIJER n. 5709, November 1918). Goenoeng Talamau, north-western slope, 1850-2100 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 784, 817 and 890, May 1917).

In the type specimens the leaves are wanting. I can now give a description of these organs.

The species proves to be rather common in the higher mountainregions of the Padangsche Bovenlanden. It is very variable in the form of the lip, which shows different stages from distinctly three lobed to almost entire.

„Flowers white to violet, with a yellow blotch on the lip." (BÜNNEMEIJER).

var. **oblongum** J. J. S. n. sp.

Mentum cum ovario angulum acutum faciens, a latere visum oblongum, supra basin incurvulum, leviter a latere compressum, obtusum. Labellum spathulatum, vix 3lobulum. Pes gynostemii apice incurvus cum excavatione.

Sumatra: Padangsche Bovenlanden, Goenoeng Malintang, 1300—1400 m., in forest. (H. A. B. BÜNNEMEIJER nrs. 4046 and 4209, July-August 1918). Laras Talang, Boekit Gombak, 1600—2000 m., in forest, common. (H. A. B. BÜNNEMEIJER nrs. 5454 and. 5710, November 1918).

The variety differs in the form of the mentum, which is not conic but oblong and somewhat compressed laterally.

The flowers are violet.

Dendrobium (sect. Calcarifera) **ventrilabium** J. J. S. n. sp.

. . . . . , Inflorescentiae brevissimae, 2—3florae, pedunculo tenui, c. 0.65 cm. longo, nonnullis vaginulis donato, rachide quaquaverse flexuosa, tenui, c. 0.65 cm. longa. Bracteae adpressae, parvae, triangulae, c. 0.23 cm. longae. Flores mediocres, c. 3.6 cm. longi. Sepalum dorsale cum ovario angulum rectum faciens, ovatum, apice angustatum, obtusum, vix apiculatum, subplanum, 7nervium, c. 1.43 cm. longum, 0.8 cm. latum. Sepela lateralia lacinia longa oblique oblonga concava ad pedem gynostemii decurrentia, mentum conspicuum marginibus anticis longitudine c. 0.25 cm. connatis calcariforme cum ovario angulum rectum faciens incurvum leviter a latere compressum dorso apicem versus obtuse carinatum obtusum fere 2 cm. longum formantia, parte antica patentia, oblique triangula, apice angustata, acutiuscula cum apiculo conico, subplana, 7nervia, c. 1.4 cm., usque apicem menti 2.65 cm. longa, basi 1.95 cm. lata. Petala patentia, oblique elliptica, brevissime apiculato-acuminata, superne repandula, concava, 5nervia, c. 1.37 cm. longa, 0.7—0.75 cm. lata. Labellum erectum, pedi gynostemii et gynostemio parallelum, inexplanatum c. 2.75 cm. longum, ungue lineari, basi longitudine c. 0.7 cm. pedi gynostemii adnato, deinde rectangule patente et pedem versus incurvo, 5nervio, appendice longitudinali late lineari canaliculata acute marginata antice supra basin laminae in dentem liberum triangulum basi in lobulum similem truncatum pedi gynostemii adpressum producta in unguis parte superiore, explanato c. 1.5 cm. longo, medio 0.37 cm. lato, lamina erecta, margine apicali angusto recurva convexa et inferius longitudinaliter 5sulcata, infra apicem valde ventricoso-concava, gynostemium

superante, explanata transversa, late subcuneato-semiorbiculari, apice leviter rotundata, obsolete triloba, explanata c. 1.37 cm. longa, 2.2 cm. lata, lobis lateralibus erectis, triangulis, margine postico rotundatis, antice subtruncatis duplicato-crenulatis, angulo exteriore plus minusve dentiformi-productis, lobo intermedio leviter producto, brevissime rotundato-bilobulo cum apiculo in sinu. Gynostemium breve, crassum, dorso convexum, margine in utraque stigmatis parte obtusangule dilatatum, c. 0.45 cm. longum, clinandrio alte excavato, transverso, filamento tenuiter subulato, auriculis brevioribus, latis, retusis, obtuse bidentatis, irregulariter marginatis. Anthera cucullata, antice visa quinquangularis, margine apicali late obtusangulo ciliato recurvo quasi truncata, bene 0.3 cm. lata. Pollinia 4, lateraliter compressa, semiobovata, supra convexa, subtus recta, 2 mediana altiora, 0.2 cm. longa. Stigma urceolatum. Pes gynostemii cum ovario angulum rectum faciens, superne incurvus, linearis, apicem versus angustatus, anguste canaliculatus, 0.2 cm. longus. Ovarium 6sulcatum, c. 0.6 cm. longum; pedicellus tenuis, c. 1.3 cm. longus.

Sumatra: Padangsche Bovenlanden, Agam, Boekit Batoe Banting. (W. GROENEVELDT, cult. sub n. 1740).

Though I have not seen the vegetative parts of this plant, I have described it as a new species, because the flowers are very characteristic and easily recognizable.

„Peduncle violet brown. Bracts brownish violet. Ovary and pedicel light olive green, the former one tinted violet. Flowers light yellowish green, the sepals with 7, the petals with 5 purple nerves, the lateral sepals and petals more or less veined transversely. Lip in the centre with 5 thin purple nerves from the base to the apex, the side lobes veined purple. Column whitish with a faint green hue. Anther white". (E. JACOBSON).

Description from inflorescences preserved in alcohol.

Dendrobium (sect. Calcarifera) **transtilliferum** J. J. S. n. sp.

Caules elongati, tenuisculi, basin et apicem versus attenuati, parte inferiore excepta flexuosi, teretes, mox longitudinaliter sulcati, pars adest ad c. 62 cm. longa, 0.6 cm. diam., internodiis ad c. 3 cm. longis, superioribus decrescentibus. Folia patentia, lanceolata ad lineari-lanceolata, apicem versus angustata, apice inaequaliter obtusa vel plerumque utroque latere oblique triangula, basi vix angustata semiamplexicaulia, costa media supra sulcata subtus non prominente, papyracea, ad c. 9 cm. longa, 1.5 cm. lata, superiora decrescentia; vaginae tubulosae, internodia aequantes. Inflorescentiae e nodis superioribus caulium defoliatorum, brevissimae, subsessiles, c. 2 - 6florae, rachide tenui, c. 0.4—1.2 cm. longa. Bracteae adpressae, oblongo-triangulae, acutae, concavae, ad c. 0.3 cm. longae. Flores c. 1.1 cm. lati, 2 cm. longi. Sepalum dorsale erectum, apice recurvum, ovato-quinquangulare, apicem versus angustatum, acutiusculum, apice convexo excepto concavum, 5nervium,

c. 0.8 cm. longum, 0.47 cm. latum. Sepala lateralia lacinia magna late oblique triangula concava ad pedem gynostemii decurrentia, mentum magnum ovario parallelum in $^1/_3$ parte supra basin obtusangule incurvulum conicum apice brevissime calcariforme ceterum antice apertum obtusum c. 1.2 cm. longum formantia, oblique erecta, divergentia, oblique triangula, acutiuscula, 5(—7)nervia, c. 0.8 cm., usque menti apicem c. 1.9 cm. longa, basi 1.43 cm. metientia. Petala oblique elliptica, acuta, basi brevissime contracta, superne erosula, convexa, 3nervia, c, 0.83 cm. longa, 0.4 cm. lata. Labellum pedi gynostemii parallelum erectum, recurvulum, gynostemium longe superans, concavum, lobis lateralibus obsoletis subsimplex, cuneato-quinquangulare, basi pedi gynostemii brevissime adnatum, supra lobos laterales rotundato-obtusos obsolete constrictum, lobo intermedio subsemiorbiculari late rotundatum, parte cuneata excepta eroso-denticulatum, costula transversa supra basin, fascia longitudinali convexa, nervis venisque in lobo medio plus minusve dense verruculosis, 5nervium, nervis exterioribus bene ramosis, explanatum totum c. 1.9 cm., usque costulam transversam 0.27 cm. longum, ad lobos laterales 0.925 cm., ad lobum medium 0.975 cm. latum. Gynostemium breve, crassum, dorso convexum, ad basin filamenti gibbosum, in utraque stigmatis parte obtusangule dilatatum, c. 0.27 cm. longum, 0.37 cm. latum, filamento longe subulato, apice incurvo, auriculis anthera paulo brevioribus, parallelis, latis, saepe apice dente sursum curvo donatis. Anthera cucullata, antice visa plana quinquangularis, apice producta, late truncata papillosaque, basi obtusa retusaque, a latere visa triangula, 0.22 cm. lata. Pollinia 4, in corpuscula 2 oblique obovata supra convexa subtus subplana unita, basi acuta, apice obtusa, a latere visa oblique obovato-pyriformia, interiora angustiora et linearia, c. 0.16 cm. longa. Stigma ovale, apice truncatum. Pes gynostemii cum ovario angulum acutum faciens, in $^1/_3$ parte supra basin et ad apicem incurvulus, linearis, apice angustatus, canaliculatus, c. 1.15 cm. longus; pedicellus, c. 0.8 cm. longus.

Sumatra: West coast, Pariaman, Kajoe Tanam. (W. GROENEVELDT, cult. sub nrs. 1816, 1817). Solok, Danau Dibaroeh. (A. V. THEUNISSEN, cult. in Hort. E. JACOBSON sub nrs. 1905, 1925).

In the form of the lip this much resembles *D. fulminicaule* J. J. S. from the same area, but in that species the lip is bilobed at the apex and the transverse bar at the base is missing. For the rest the two plants are very different.

„Stems greenish yellow or yellowish brown. Pedicel and ovary light green or greenish yellow, the latter more or less dotted with purple. Sepala and petals transparently light yellow, the former outside more or less tinged or dotted with light purple, the petals on the back only with a similar line. Lip transparently light yellow, inside with an ochraceous or orange longitudinal band. Column light yellow. Smell of honey". (E JACOBSON).

Description from materials preserved in alcohol.

Dendrobium (sect. Pedilonum) **quadrialatum** J. J. S. n. sp.

Caules elongati, crassi, sicco leviter serpentini, parte adest ad c. 18 cm. longa, internodiis ad c. 2 cm. longis. Folia patentia, lanceolata, obtusa, paulo inaequaliter rotundato-biloba, basi semiamplexicaulia, coriacea, c. 8 cm. longa, 2 cm. lata, superiora minora; vaginae tubulosae, internodium superantes. Inflorescentiae e nodis caulium defoliatorum, numerosae, erecto-patentes, sessiles, breves, dense pluriflorae, rachide c. 1.8 cm. longa. Bracteae conspicuae, oblongae ad ovatae, acuminatae, acutae, concavae, ad c. 1.75 cm. longae. Flores c. 9, mediocres, macerati c. 2.5 cm. longi. Sepalum dorsale oblongum, superne angustatum, acutum, triquetro-apiculatum, praesertim inferne valde convexum, 5nervium, bene 1.5 cm. longum, 0.62 cm. latum. Sepala lateralia lacinia oblique oblonga basin versus angustata curvata ad pedem gynostemii decurrentia, mentum reversum apice excepto ovario adpressum incurvulum oblongo-conicum apice angustatum obtusum dorso convexum c. 0.95 cm. longum formantia, marginibus anticis longitudine c. 0.2 cm. connata, parte antica oblique ovato-oblonga, apice conduplicato-subobtusa, dorso praesertim apicem versus carinata, carina ultra apicem producta, 6nervia, bene 1.5 cm., in totum 2.4 cm. longa, 0.74 cm. lata. Petala oblique oblongo-subobovata, apice subrectangule acuta subconduplicata et dorso carinata, inferne cuneato-angustata, 3nervia, bene 1.3 cm. longa, 0.5 cm. lata Labellum pedi gynostemii et gynostemio parallelum, pedi gynostemii longitudine c. 0.5 cm. adnatum, concavum, angustum, medio constrictum, gynostemium superans, appendice hippocrepidiformi postice rotundata margine elevata recurvataque in $^2/_5$ partibus supra basin, 5nervium, nervis exterioribus basi furcatis, omnibus in parte contracta prominulis, c. 1.6 cm., explanatum 1.8 cm. longum, ungue oblongo, concavo, c. 0.7 cm. longo, 0.33 cm. lato, lamina oblonga, breviter acute acuminata, concava, c. 1.1 cm. longa, 0.375 cm., basi contracta 0.18 cm. lata. Gynostemium recurvulum, a dorso compressum, absque anthera c. 0.36 cm. longum, clinandrio transverso, excavato, filamento subulato, auriculas apice obtusangulas superante. Stigma quandragulum. Pes gynostemii apice excepto ovario adpressus, incurvus, valde concavus, c. 1 cm. longus. Ovarium quadrialatum, facie inferiore exalatum, c. 0 7 cm. longum, cum pedicello tenuiore aequilongo leviter signoideum.

Ternate: Toramadiahi, 550 m., epiphytical in forest. (V. M. A. BEGUIN n. 1187, November 1920).

This seems to be nearest to *D. bracteosum* RCHB. F. from New-Guinea, which has also rather large bracts, but the stems are much thicker, the leaves larger, the flowers broader with a narrower lip provided with a rounded appendix.

„Flowers violet, lip red. Stems 35 cm. long". (BEGUIN).

Description from herbarium, which consists in a few upper portions of the stems.

Dendrobium (sect. Calyptrochilus) **inopinatum** J. J. S. n. sp.

Caules approximati, leviter flexuosi, c. 46 cm. longi, internodiis c. 1.4—2.4 cm. longis, radicibus crassis. Folia patentia, anguste lanceolata, apicem versus sensim angustata, oblique acuta vel anguste obtusa, coriacea, nervis sicco supra subtusque prominentibus, sicco subtus glaucescentia, ad c. 8 cm. longa, 1.35 cm. lata; vaginae tubulosae, apice truncatae, nervis sicco prominentibus. Inflorescentiae e nodis superioribus caulium defoliatorum, brevissime racemosae, cauli adpressae, dense c. 8florae, pedunculo c. 0.2 cm. longo, nonnulis vaginulis brevibus tubulosis donato, rachide c. 0.4 cm. longa. Bracteae patentissimae, triangulae, subacutae, concavae, c. 0.275 cm. longae, 0.2 cm. latae. Flores quaquaversi, longe pedicellati, c. 1.6 cm. longi. Sepalum dorsale ovato-ovale, apice obtusum et minute denticulatum, leviter concavum, 5nervium, c. 0.62 cm. longum, c. 0.4 cm. latum. Sepala lateralia lacinia longa oblique oblonga concava c. 0.64 cm. longa ad pedem gynostemii decurrentia, marginibus anticis longitudine c. 0.3 cm. connata, mentum subcylindraceum cum ovario angulum anguste acutum faciens dorso laxe undatum obtusum c. 1 cm. longum formantia, oblique ovata, obtusa, concava, c. 6nervia, c. 0.64 cm., usque apicem ovarii 1.45 cm. longa, basi 1.25 cm. metientia. Petala oblique elliptica, obtusa, basin obliquam versus angustata, dimidio superiore eroso-denticulata, concava, bi- subtrinervia, c. 0.64 cm. longa, 0.3 cm. lata. Labellum spathulatum, concavum, basi gynostemii brevissime adnatum, $^2/_5$ partibus inferioribus pedi gynostemii adpressum et vix ventricosum, deinde leviter obtusangule a pede recurvum, parte dilatata utrinque gynostemio adpressum, gynostemium paulum superans, margine apicali abrupte incurvo lacinulato cucullatum, cuculla a dorso compressa rotundata, 5nervium, intus in flexu incrassatione ∧formi biloba instructum, explanatum c. 1.37 cm. longum, ungue lineari, superne leviter contracto, c. 0.65 cm. longo, inferne 0.28 cm. lato, lamina (subexplanata) late ovata, rotundata, basi contracta, c. 0.7 cm. longa, 0.5 cm. lata. Gynostemium crassum, dorso convexum, c. 0.275 cm. longum, clinandrio transverso, concavo, filamento subulato, incurvo, cum gynostemio angulum obtusum faciente, auriculis anthera brevioribus, oblique quadrangulis, truncatis, repando-tridenticulatis. Anthera cucullata, antice plana et suborbicularis, apice late truncata papillosaque, a latere visa triangula. Pollinia 4, oblique anguste oblonga, supra convexa, subtus concava, c. 0.17 cm. longa. Stigma magnum, faciem inferiorem gynostemii omnino occupans, obovatum, apice truncatum. Pes gynostemii cum ovario angulum anguste acutum faciens, leviter undatus, linearis, parte superiore paulum contractus, apice leviter dilatatus tenuis et excavatione longitudinali instructus, bene 1 cm. longus. Ovarium teres, curvatum, apice valde obliquum, 6sulcatum, c. 0.8 cm. longum, cum pedicello tenui c. 1.5 cm. longo sigmoideum.

Sumatra: Ophir districts, Tanang Taloe, 1100 m., in forest. (H. A. B. BÜNNEMEIJER n. 1132, June 1917).

The discovery of a typical member of the section *Calyptrochilus* in Sumatra is very interesting.

The short description of *D. aegle* RIDL. is somewhat suggestive of this species, but the leaves are broader, the pedicels shorter, the bracts lanceolate, the mentum only $^1/_4$ inch, the petals shorter and broader than the sepals, the lip without a callus and the anther conic.

The flowers are said to be violet.

Description from a single dried specimen, the flowers of which were preserved in alcohol.

Dendrobium (sect. Calyptochilus) **crepidiferum** J. J. S. n. sp.

Caules elongati, leviter flexuosi, internodiis c. 2—2.5 cm. longis. Folia patentia, lanceolata, apicem versus sensim angustata, breviter subacuta, apiculata, basi angustata, sicco papyracea, ad c. 10 cm. longa, 1.85 cm. lata; vaginae tubulosae, atropunctatae, internodia aequantes. Inflorescentiae e nodis caulium defoliatorum, brevissimae, c. 3florae, pedunculo cum rachide c. 0.9 cm. longo. Bracteae ovatae, acuminatae, concavae, sicco membranaceae, semipellucidae, atropunctatae, c. 0.7 cm longae. Flores majusculi, pulchri, macerati c. 4.8 cm. longi. Sepalum dorsale lanceolatum, anguste obtusum, 5nervium, c. 2.9 cm. longum, 0.8 cm. latum. Sepala lateralia lacinia oblique elongato-triangula ad pedem gynostemii decurrentia, mentum conspicuum reversum ovario parallelum subrectum apice incurvulum anguste conicum apice leviter contractum anguste obtusum c. 1.9 cm. longum formantia, oblique oblonga, dimidio superiore angustata, acuta, margine antico basi longitudine c. 1 cm. connata, 1nervia, c. 2.9 cm., usque apicem pedis gynostemii 4.6 cm. longa, 1.15 cm. lata. Petala lanceolata, obtusa, basin versus sensim longe angustata, c. 2.9 cm. longa, 0.775 cm. lata. Labellum parallelum pedi gynostemii et gynostemio erectum, basi pedi gynostemii longitudine c. 0.7 cm. adnatum, anguste spathulatum, canaliculatum, subtus convexum, 7nervium, intus in $^1/_3$—$^2/_5$ partibus supra basin incrassatione ∨formi instructum, apice margine incurvo obtuse conico-cucullatum, margine apicali acutangule excisum erosumque, c. 2.85 cm. longum, lamina 0.6 cm. lata. Gynostemium dorso excavatum, marginibus antice in utraque stigmatis parte obtusangule dilatatum, c. 0.55 cm. longum, clinandrio excavato, filamento arcuato, subulato, auriculis conspicuis parallelis semiovalibus rotundatis aequilongo. Anthera majuscula, cucullata, antice visa quadrangula, apice incurvo late rotundata et dense papillosa, c. 0.28 cm. lata. Pollinia 4, in corpuscula 2 suboblique oblonga subobovata a dorso compressa supra convexa subtus concava c. 0.23 cm. longa unita. Pes gynostemii superne curvulus, linearis, canaliculatus, c. 2 cm. longus. Ovarium pedicellatum leviter clavatum, leviter sigmoideum, 6sulcatum, c. 3 cm. longum.

Ternate: Toramadiahi, c. 1200 m., epiphytical in forest. (V. M. A. BEGUIN n. 1190, November 1920).

In the form of the flowers this recalls to mind *D. Hasseltii* LNDL. and *D. glomeratum* ROLFE as figured in Gard. Chr. 1894, I, 653. The lip is rather narrow in the section and approaches *Pedilonum* very closely. Indeed, the sections *Pedilonum*, *Calyptrochilus*, *Calcarifera*, *Platycaulon* and others are not equivalent to such ones as *Desmotrichum*, *Diplocaulobium*, *Grastidium* etc., but should be regarded as subsections.

„Stems dependent, 1 m. long. Flowers violet, as it were covered with small crystals, lip red". (BEGUIN).

Description from dried specimens.

Dendrobium (sect. Eudendrobium) **batakense** J. J. S. n. sp.

Caules tenues, hic illic radicem tenuem emittentes, pars adest ad 37 cm. longa, internodiis 3—4.5 cm. longis. Folia lineari-lanceolata, apicem versus angustata, oblique acuta, apice minutissime erosulo-crenulata, margine recurvula, costa media supra sulcata subtus prominente, papyracea, ad c. 5—5.5 cm. longa, 0.8 cm. lata; vaginae tubulosae, internodiis aequilongae vel paulo breviores, apice truncatae. Inflorescentiae in caulibus foliatis inter et infra folia, vaginam dorso perforantes, patentissimae, brevissimae, 1—2florae, pedunculo vaginulato cum rachide flexuosa c. 0.5—0.6 cm. longo. Bracteae adpressae, triangulae, breviter acute acuminatae. Flores c. 1.75 cm. lati, 2 cm. longi. Sepalum dorsale ovarium continuum, apice recurvulum, oblongo-triangulum, acutum, breviter apiculatum, 5nervium, c. 1.2 cm. longum, 0.46 cm. latum. Sepala lateralia cum pede gynostemii mentum anguste conicum cum ovario angulum acutum faciens dorso dimidio inferiore rectum dimidio superiore leviter convexum obtusum c. 0.75 cm. longum formantia, margine antico basi breviter connata, divergentia, oblique anguste triangula, acuta, basi antice oblique dilatata, 5nervia, c. 1.2 cm. longa, basi 0.85 cm. lata. Petala oblique rhombeo-lanceolata, acuta, 3nervia, c. 1.2 cm. longa, 0.4 cm. lata. Labellum apici calcariformi pedis gynostemii insertum, pedi gynostemii parallelum, recurvum, gynostemium longe superans, concavum, subtus convexum cum sulco longitudinali, trilobum, intus fascia mediana dense pubescens, lobis margine lato excepto muriculato-pilosum praesertim in nervis, 5nervium, explanatum ex ungue brevi ambitu rhombeum, c. 1.6 cm. longum, ad lobos laterales 0.95 cm. latum; lobi laterales erecti, gynostemium superantes, concavi, oblique quadranguli, obtusissimi, superne acute denticulati; lobus intermedius ovato-triangulus, breviter acute acuminatus, denticulatus, concavus, c. 0.5 cm. longus et latus. Gynostemium breve, crassum, c. 0.32 cm. longum, clinandrio transverso, excavato, filamento subulato, auriculis breviore, auriculis triangulis, falcato-incurvis, obtusis, margine postico dente instructis. Anthera cucullata, antice plana et subor-bicularis, apice breviter obtusangule triangulo-producta et minute lacinulato-denticulata, c. 0.15 cm. lata. Pollinia 4, angusta, supra convexa, subtus concava, a latere visa falcatula, interiora quam exteriora paulo longiora, c. 0.13 cm. longa. Stigma longitudinale, oblongum, margine inferiore rotun-

datum, margine superiore truncatum. Pes gynostemii cum ovario angulum acutum faciens, late linearis, dimidio inferiore fere rectus, vix curvulus, dorso 3costatus, antice leviter concavus et puberulus, parte superiore leviter angustatus, incurvulus, apice calcariformis, totus c. 0.8 cm. longus. Ovarium 6sulcatum, c. 0.4 cm. longum, cum pedicello c. 0.75 cm. longo sigmoideum.

Sumatra: Bataklanden, Siborborong, 1100 m. (W. GROENEVELDT, cult. sub n. 1972).

This is, I think, best placed in *Eudendrobium*, among the species with the flowers on the leafy stems. I do not know a near ally.

„Rachis greenish. Pedicel and ovary very light green. Sepals white, base very light purple, tips very light green, mentum transparently yellowish green. Petals white with a very light purple hue, tips a little darker. Lip basal half with a greenish hue, with a purple blotch and purple hairs; side lobes with parallel purple veins, midlobe pure white. Column white, the stigma bordered with a thin purple line. Anther white with a faint greenish tint and a purplish blotch on the back." (E. JACOBSON).

Description from materials preserved in alcohol.

Bulbophyllum (sect. Dialeipanthe) **linggense** J. J. S. n. sp.

Rhizoma breve, repens, radicans, vaginis tubulosis mox fatiscentibus et fibras paucas relinquentibus tectum. Pseudobulbi c. 0.6 cm. dissiti, cum rhizomate angulum acutum facientes, oblique ovoidei, sicco c. 1 cm. longi, 1folii. Folium lanceolatum, subacuminatum, obtusum, basi petiolato-contractum, subtus minute puncticulatum, sicco coriaceum et nervis subtus prominentibus, totum c. 15—16.5 cm. longum, parte contracta 2—2.7 cm. longa, 1.8—2.6 cm latum. Inflorescentiae e basi pseudobulborum, adscendentes, apice dense multiflorae, pedunculo firmiter filiformi, c. 24.5 cm. longo, vaginulis c. 3 tubulosis donato, rachide incrassata, tereti, 3.2 cm. superante, internodiis c. 0.15 cm. longis. Bracteae alternatim bifariae, erecto-patentes, rachidem amplectentes, late triangulae, apice subulato-carinatae, conduplicato-concavae, punctatae, c. 0.4 cm longae. Flores intervallis florentes, mediocres. Sepalum dorsale lineare, apicem versus sensim angustatum, acutissimum, canaliculatum, 5(–7)-nervium, c. 2.5 cm. longum, 0.34 cm. latum. Sepala lateralia oblique linearia, apicem versus sensim angustata, acutissima, basi margine anteriore paulo dilatata, conduplicato-canaliculata, 7nervia, costa media dorso prominente, cum sepalo intermedio dorso praesertim ad basin minute puncticulata, c. 2.5 cm. longa, basi 0.575 cm. lata. Petala minima, gynostemio adpressa, oblique transverse oblonga, leviter rotundata, erosulo-repandula, brevissime obtuse apiculata, 3nervia, c. 0.08 cm. longa, 0.18 cm. lata. Labellum mobile, porrectum, supra basin recurvum, apice sensim incurvulum, lanceolatum, $^2/_5$ partibus superioribus subulato-acuminatum, basi concavum, ceterum convexum, supra basin usque medium fere leviter verruculosum, basi subtus convexum cum sulco longitudinali, carinis 2

longitudinalibus erectis supra basin altissimis rotundatis et facie introrsa convexo-incrassatis canaliculo separatis ante labelli partem concavam valde decrescentibus convexis et leviter verruculosis cum canaliculo medio fere evanescentibus, carnosum, c. 2.45 cm. longum, 0.5 cm. latum. Gynostemium rectum, a dorso compressum, oblongum, dorso convexum, subtus concavum, semiteres, c. 0.35 cm. longum, clinandrio alte excavato, semiorbiculari, oblique truncato. Anthera cucullata, basi in clinandrium immersa, subsemiorbicularis, apice truncata, connectivo antice triangulo-incrassato, fere c. 2 cm. lata. Pollinia 4, oblonga, a latere compressa, exteriora extus convexa. Rostellum distinctum, porrectum, late obtuse triangulum. Stigma quadrangulum. Pes gynostemii cum ovario angulum obtusum fere rectum faciens, incurvulus, lineari-oblongus, truncatus, sulco intramarginali in gynostemium decurrente utrinque, bene 0.4 cm. longus. Ovarium obconicum, curvulum, 6sulcatum, furfuraceo-puncticulatum, c. 0.35 cm. longum; pedicellus tenuior, fere epunctatus, c. 0.4 cm. longus.

Lingga Archipelago: Poeloe Lingga, Goenoeng Daik, 500 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 6694, July 1919). Poeloe Singkep, Kampoeng Baroe, 40 m., epiphytical in forest. (H. A. B. BÜNNEMEIJER n. 7369, August 1919).

This differs from the allied species known from the neighbouring regions a. o. in the very short transverse petals. These are very much the same in *B. Theunissenii* J. J. S., but here the lip has distinct side lobes.

„Flowers violet, yellow striped violet at the base." (BÜNNEMEIJER n. 6694).

„Flowers light brown striped dark brown. Upper portion of lip almost wholly brown red." (BÜNNEMEIJER n. 7369).

Description from herbarium and one flower preserved in alcohol.

In n. 6694 the flowering part of the inflorescence is wanting whereas n. 7369 lacks flowers. I have no doubt that both numbers represent the same species.

Bulbophyllum (sect. Polyblepharon) **languidum** J. J. S. n. sp.

Rhizoma dependens, basi tantum radicans, flaccidum, ramosum, tenue, serpentinum, c. 30 cm. longum, vaginis mox fatiscentibus paucos nervos relinquentibus tectum. Pseudobulbi c. 1 cm. dissiti, rhizoma continui, basi eo adpressi et rhizoma amplectentes, dimidio superiore patentes et cum rhizomate angulum acutum facientes, sicco satis tenues, facie rhizoma versus spectante canaliculati, c. 0.6—0.75 cm. longi. Folium ovato-lanceolatum, acutum, longius mucronatum, basi obtusum, c. 9nervium, ad c. 2.75 cm. longum, 0.8 cm. latum. Inflorescentiae e nodis rhizomatis, fasciculatae, vaginulis amplectentibus tectae, succedanee florentes, pedunculo c. 0.45 cm. longo. Bractea infundibuliformis, c. 0.08 cm. longa. Flos parvus, maceratus fere 0.4 cm. longus, sepalis petalisque conniventibus apice recurvis. Sepalum dorsale quinquangulari-ovatum, acutum, concavum, 3nervium, 0.36 cm.

longum, 0.18 cm. latum. Sepala lateralia oblique triangula, acuta, vix apiculata, ciliolata, 3nervia, c. 0.36 cm. longa, 0.175 cm. lata. Petala e basi oblique oblonga superne longius ciliata c. 0.16 cm. longa 0.07 cm. lata in appendicem elongatam filiformem basi ciliatam deinde papillosam apice recurvulo glabram c. 0.225 cm. longam contracta, 1nervia. Labellum mobile, valde undatum, unguiculatum, 3nervium, explanatum c. 0.3 cm. longum, ungue lineari, callo conspicuo reverso a latere compresso (macerato) triangulo acuto donato, c. 0.1 cm. longo, lamina basi concava, ceterum convexa, marginibus recurvis longius ciliata, c. 0.2 cm. longa, e basi ovato-triangula c. 0.75 cm. lata dimidio superiore in appendicem subteretem subclavatam obtusam puberulam contracta. Gynostemium verisimiliter a dorso compressum, c. 0.1 cm. longum, clinandrio concavo, filamento subulato, auriculis filamentum superantibus, subulatis, falcatis, margine inferiore dente multo minore instructis. Anthera cucullata, basi late obtusangule excisa, apice lato truncato breviter incurva, c. 0.05 cm. lata, connectivo valde gibboso, a latere compresso, obtuso, papilloso. Pollinia in unum transverse subglobosum convexum subtus subplanum unita, 2 interiora minima. Pes gynostemii cum ovario angulum obtusum faciens, carnosus, canaliculatus, apice abrupte rotundato-attenuatus, c. 0.04 cm. longus. Ovarium pedicellatum c. 0.075 cm. longum.

Ternate: Toramadiahi, c. 600 m. (V. M. A. BEGUIN n. 1335, January 1921).

In the form of the petals this resembles the Papuan *B. palilabre* J. J. S., which, however, in all other respects is quite different.

„Stems dependent. Leaves dark green. Flower greenish white with a little violet". (BEGUIN).

Description from herbarium.

Bulbophyllum (sect. Fruticicola) **perductum** J. J. S. in Fl. Buit. VI, Orch. (1905), 451; Atlas Fig. CCCXLIII.

var. **sebesiense** J. J. S. n. var.

Labellum subtus et basi purpureum, apice flavum, supra apicem flavescens purpurascenti-suffusum. Gynostemium pallide flavescens, pede basi excepta purpureum.

Island of Sebesi: Soenda Street. (W. M. DOCTERS VAN LEEUWEN, liv. pl. cult. in his garden).

The variaty differs mainly in the colour of the lip.

Sarcochilus clausus J. J. S. n. sp.

Caulis abbreviatus, c. 2 cm. longus, internodiis brevibus, radicibus crassiusculis. Folia oblique oblonga, apice angustata et altius oblique bidentata, dentibus triangulis anguste obtusis (vel acutis?), basi angustata et breviter contracta, costa media supra sulcata subtus obtuse prominente, carnosa,

dilute viridia, c. 11 cm. longa, 3.8 cm. lata; vagina brevis, tubulosa, margine recurva, dilute viridis. Inflorescentia laxe pluriflora, quaquaversa, pedunculo. . . . . , rachide angulata, c. 11.5 cm. longa, internodiis c. 1—1.6 cm. longis, facie florem versus spectante excavatis. Bracteae adpressae, rachidem semiamplectentes, breves, late triangulae, obtusissimae, concavae, ad c. 0.4 cm. longae. Flores c. 10, majusculi, c. 3.25 cm. longi. Sepalum dorsale erectum, apice obtusangule incurvum, valde concavum, oblongum, apice vix contracto retusoque minutissime erosulum, dorso et intus ad basin parce furfuraceum, 5nervium, c. 1.7 cm. longum, 0.7 cm. latum. Sepala lateralia ad pedem gynostemii decurrentia, reflexa, dorso ovario adpressa, deorsum spectantia, oblique obovato-rhombea, apice contracta et rotundata, basi obliqua, dorso et intus ad basin parce furfuracea, 5nervia, c. 1.55 cm. longa, bene 1 cm., basi 0.7 cm. lata. Petala reflexa, basi convexa, ceterum concava, oblique subspathulato-oblonga, obtusissima, superne erosula, 3nervia, c. 1.4 cm. longa; basi 0.325 cm., superne bene 0.6 cm. lata. Labellum parvulum, mobile, calcaratum, 3lobum, a latere compressum, c. 0.83 cm. longum, ab apice lobi intermedii usque apicem calcaris 0.975 cm., a basi usque apicem calcaris 0.76 cm. metiens, 0.36 cm. latum, ambitu a latere visum triangulum, margine postico leviter, margine antico manifeste sigmoideum; lobi laterales latissimi, brevissimi, margine leviter rotundati, crasse carnosi, antice incrassatione transversa alte excisa bilobula conjuncti, lobulis trigonis obtusis; lobus intermedius adscendens, triangulus, satis acutus, apice attenuatus, subtus convexus, c. 0.32 cm. longus; calcar deorsum spectans, pedem gynostemii continuum, vix incurvulum, leviter a latere compressum, conicum, obtusum, basi ampliatum, fauce lamella horizontali omnino adnata carnosula ad basin lobi intermedii tantum perforata costula longitudinali instructa clausum. Gynostemium gracile, clavatum, rectum, absque anthera 1.1 cm. longum, clinandrio concavo, transverse subovali. Rostellum conspicuum, cum gynostermio angulum subrectum faciens. Stigma magnum, concavum, orbiculare. Pes gynostemii basi ovario adnatus, cum ovario angulum acutum, cum gynostemio angulum rotundato-rectum faciens, incurvulus, linearis, carnosus, apice antice calloso-incrassatus, totus c. 1.1 cm. longus. Ovarium sessile, tenue, 6sulcatum, apice valde obliquum, c. 2.7 cm. longum.

Sumatra: Padangsche Bovenlanden, Boekit Paloempang near Sidjoengdjoeng. (A. V. THEUNISSEN, cult. in Hort. E. JACOBSON sub n. 1632).

A very interesting species with the entrance of the spur closed by a horizontal plate which has a hole near the base of the midlobe.

„Ovary very light yellow. Sepals and petals dark yellow, suffused with light violet, apex white. Lip white spotted violet at the base and in the middle, inside light yellow with a violet ring at the mouth of the spur. Column brownish yellow, apex greenish yellow, anther yellow; foot base light yellow, apex white stained with light violet." (E. JACOBSON).

Description from a weak living plant without flowers, and inflorescences preserved in alcohol.

CORDIGLOTTIS J. J. S. n. gen.

Sepalum dorsale et petala subsimilia. Sepala lateralia paulo latiora, ad pedem gynostemii decurrentia. Labellum apici pedis gynostemii elastice (?) insertum, simplex, ecalcaratum, e basi unguiculata valde dilatatum, cordatum, concavum, cum callo transverso in medio. Gynostemium majusculum, latum, pede conspicuo. Anthera transversa. Pollinia 4, subaequalia, stipite late cuneato, glandula conspicua. Stigma magnum.

Caulis brevis. Folia teretia. Inflorescentiae apice dense multiflorae, quaquaversae. Flores singulatim florentes.

This new genus is perhaps nearest to *Thrixspermum*, from which it differs in the unguiculate not saccate lip, the long bent column, the nearly equal pollinia and the large stigma. From *Chroniochilus*, *Chamaeanthus* and *Sarcochilus* it is distinguished readily by the four pollinia.

Cordiglottis Westenenkii J. J. S. n. sp.

Caulis teres, c. 2.5 cm. longus, internodiis c. 0.6—0.7 cm. longis, radicibus cauli aequicrassis. Folia patentia, elongata, teretia, tenuia, obtusa, esulcata, ad c. 17 cm. longa, 0.15 cm. diam.; vaginae tubulosae, laeves, c. 0.175 cm. diam. Inflorescentiae vaginam perforantes, patentissimae, dense multiflorae, diu flores gignentes, glabrae, pedunculo filiformi, apice obconico-incrassato, c. 1.3—2 cm. longo, nonnullis vaginulis tubulosis donato, rachide incrassata, 1.4 cm. vel plus longa, c. 0.16 cm., cum bracteis 0.4 cm. diam., internodiis abbreviatis. Bracteae patentissimae, rachidem semiamplectentes, triangulae, concavae, dorso valde carinatae, carina apice producta, carnosulae, dorso c. 0.15 cm. longae. Flores singulatim florentes, bene aperti, c. 1.1 cm. lati. Sepalum dorsale apice recurvum, oblongum, breviter acutum, basin versus paululum angustatum, convexum, 5nervium, c. 0.7 cm. longum, 0.225 cm. latum. Sepala lateralia ad pedem gynostemii decurrentia, oblique oblongo-triangula, apicem recurvum versus angustata, obtusa, convexa, 5nervia, costa media dorso leviter incrassata praesertim superne, c. 0.65 cm. longa, fere 0.35 cm. lata. Petala fere in medio recurva, oblique anguste subspathulata, obtusa, 3nervia, c. 0.7 cm. longa, basi fere 0.125 cm., superne 0.175 cm. lata. Labellum apici pedis gynostemii insertum, mobile (?), sigmoideum, simplex, latum, unguiculatum, 3nervium, nervis exterioribus basi furcatis, callo parvulo transverso inclinato apice vix libero subtrapeziformi truncato in medio labelli, explanatum totum c. 0.7 cm. longum, ungue cuneato-quadrangulo, concavo, dorso convexo, c. 0.17 cm. longo, basi 0.16 cm., apice 0.275 cm. lato, lamina concava, marginem versus convexa, late subreniformi-triangula, obtusa, lobis basilaribus rotundatis, c. 0.54 cm. longa, 0.82 cm. lata. Gynostemium majusculum, leviter curvatum, latum, a

dorso compressum, ovali-oblongum, dorso convexum, apice oblique truncatum, c. 0.35 cm. longum, clinandrio transverse ovali, concavo cum costula longitudinali, margine postico (apice) late rotundato retuso. Anthera cucullata, transverse aequilateraliter subtrapeziformis, apice lato breviter bidentata erosulaque, tenuis, c. 0.2 cm. lata. Pollinia 4, paulo inaequimagna, a dorso compressa, subovata, basi truncata, 2 postica quam antica paulo angustiora, c. 0.08 cm. longa, stipite lato, cuneato, antice convexo, parte superiore dilatato rotundato leviter concavo, cum glandula majuscula triangula apice lato recurva c. 0.13 cm. longo. Rostellum bidentatum, dentibus remotis. Stigma magnum, alte excavatum, ovato-orbiculare, basi apiceque truncatum. Pes gynostemii cum ovario angulum acutum faciens, vix incurvulus, oblongus, apicem versus leviter angustatus, truncatus, c. 0.25 cm. longus. Ovarium pedicellatum 6sulcatum, c. 0.5 cm. longum.

Sumatra: Benkoelen, Lebong, Rimbo Pengadang. (L. C. WESTENENK, June 1916, AJOEB n. 223). Oostkust, Besitan-river, Boekit Koeboe. (C. R. W. K. VAN ALDERWERELT VAN ROSENBURGH, from a sketch).

Only one species of this new genus is hitherto known to science, but it is possible that another one grows in Borneo, where it was collected by Dr. R. SCHLECHTER. Unfortunately, as Dr. SCHLECHTER wrote me, his material has been lost.

The native collector AJOEB describes the flowers as red with a yellow lip. On the sketch in watercolours by Mr. VAN ALDERWERLT VAN ROSENBURGH the sepals and petals are chestnut brown with a yellow midline, the sepals bordered with the same colour and the lip yellow with brown dots.

Description from a single specimen preserved in alcohol.

Thrixspermum (sect. Dendrocolla) **longipilosum** J. J. S. n. sp.

Caulis elongatus, sectione transversa ovalis, c. 20 cm. longus, 0.275 cm. latus, internodiis c. 0.85—0.95 cm. longis, radicibus singulis elongatis vaginam supra inflorescentiam perforantibus. Folia patentia, recurvula, ligulata, apice inaequaliter obtuse biloba et manifeste erosa, basi paulum angustata, concava, dorso convexa, costa media supra sulcata subtus ad apicem carinata, carnosula, c. 5—5.5 cm. longa, 1.2—1.5 cm. lata; vagina tubulosa, longitudinaliter prominenter nervosa, bene 0.4 cm. lata. Inflorescentiae vaginam dorso ad basin perforantes, adscendentes, folia multo superantes, apice dense multiflorae, pedunculo satis valido, rigido, tereti, apice obconico-incrassato, c. 17—21 cm. longo, 0.15 cm. diam., vaginulis c. 3 in parte inferiore, rachide crassa, c. 1.5 cm. longa, 0.4 cm., cum bracteis 1.1 cm. diam. Bracteae quaquaversae, subpatentissimae, e basi lata rachidem semiamplectente crassiuscule triangulo-subulatae, acutae, concavae, dorso angulatae, c. 0.5 cm. longae. Flores intervallis expansi, mediocres, c. 2.1 cm. lati, sepalis petalisque patentissimis. Sepalum dorsale e basi unguiculato-contracta subabrupte in laminam oblongo-ellipticam brevissime apiculatam dilatatum,

concavum, supra basin 5nervium, totum fere 1.2 cm. longum, 0.54 cm. latum, ungue 0.2 cm. longo, 0.25 cm. lato. Sepala lateralia patentissima, e basi leviter cuneato-contracta oblique subovata, obtusissima, margine antico basi recurvula, obtusangule concava, dorso carinata, 5nervia, fere 1.2 cm. longa, 0.57 cm. lata. Petala oblique spathulata, ex ungue quadrangulo in laminam subovalem obtusissimam dilatata, bene concava, 3nervia, fere 1:1 cm. longa, fere 0.5 cm., ungue 0.225 cm. lata. Labellum basi lata pedi gynostemii insertum, saccatum, 3lobum, ex apice lobi intermedii usque apicem ovarii c. 0.825 cm., ex apice loborum lateralium usque apicem calcaris c. 0.9 cm, metiens (absque pilis), explanatum bene 0.7 cm. longum, 1.3 cm. latum, callo transverso inclinato quadrangulo truncato medio vix producto vel plus minusve trilobulato vel tridentato glabro intus in flexu, fascia villosa longitudinali e callo in saccum decurrente, lobis lateralibus utrinque longissime lobo intermedio extus et margine longe clavato-pilosis; lobi laterales magni, erecti, incurvuli, gynostemium bene superantes, leviter concavi, oblique trianguli, margine postico rotundati, margine antico recti, apice rotundati; lobus intermedius oblique erectus, cum calcari angulum obtusum faciens, concavus, supra visus late triangulus, subtus infra apicem rectangule conico-incrassatus, explanatus semiovalis, lobos laterales aequans, cum eis angulos obtusos faciens, c. 0.13 cm. longus, 0.36 cm. latus; calcar saccatum, dorso pedem gynostemii continuum et supra basin fere rotundato-rectangule incurvum, apice fere truncato-obtusissimum, sulco longitudinali retusum, usque apicem ovarii c. 0.55 cm. longum. Gynostemium rectum, latum, apice angustatum et vix oblique truncatum, subtus inferne (cum pede) marginibus manifeste rotundato-dilatatis excavato-concavum, c. 0.3 cm. longum, clinandrio leviter concavo, apice breviter producto et obtuse bilobulato, pede cum ovario angulum subrectum faciente, c. 0.2 cm. longo. Anthera cucullata, tenuis, rotundato-quadrangula, apice medio leviter retusa et dente minuto triangulo acuto apiculata, c. 0.125 cm. lata. Pollinia 4, inaequalia, ovali-oblonga, apice rotundata, antice convexa, postica minora, cum stipite brevissimo apice libero triangulo et glandula parva semilunata c. 0.13 cm. longa. Rostellum brevissimum, remote bidentatum. Stigma transverse ellipticum. Ovarium 6sulcatum, c. 0.9 cm. longum.

Sumatra: Bantjah, Goenoeng Singgalang. (E. JACOBSON, cult. sub n. 1572).

The species is nearly allied to *Th. squarrosum* J. J. S. of Java. It differs from the latter in the much more robust scapes, larger flowers, a rounded midlobe and the side lobes being very hairy outside. Perhaps they will prove to be local forms.

„Peduncle yellowish green. Ovary light yellowish green. Sepals and petals transparently white, faintly tinted with yellow. Lip light yellow, dotted light brown. Column white. The flowers have a strong and unpleasant odour, in the way of *Vanda helvola* BL." (E. JACOBSON).

Description from plants preserved in alcohol.

var. **korintjiense** J. J. S. n. var.

Folia sicco c. 0.7—1 cm. lata. Pedunculus validus, c. 25—38 cm. longus; rachis ad c. 5 cm. longa, cum bracteis ad c. 1.5—1.7 cm. diam. Bracteae ad c. 0.7—0.8 cm. longae. Labelli lobus intermedius breviter pilosus. Fructus c. 9.5 cm. longus.

Sumatra: West coast, Korintji Peak, 1100—1600 m., forest on trees. (H. A. B. BÜNNEMEIJER nrs. 8380, 8611, 8679, 8750, 8784, 8901, 8956, March 1920).

Differing from the type in the stronger inflorescences, longer bracts, and the hairs of the midlobe of the lip being much shorter.

Microsaccus dempoensis J. J. S. n. sp.

Pusillus. Caulis dependens, c. 5.5 cm. longus, dense foliatus, basi tantum radicans, cum foliis c. 0.7—0.9 cm. latus, internodiis c. 0.1—0.125 cm. longis. Folia subpatentissima, equitantia, lateraliter compressa, oblique oblonga, apice angustata, margine superiore et inferiore praesertim superne curvata, obtusa vel subacuta, lateribus convexa et transverse rugulosa, supra c. $^3/_4$ partibus inferioribus excavatione triangula vaginato-fissa, carnosa, tota c. 0.475—0.6 cm. longa, 0.225—0.26 cm. lata; vagina brevissima, tubulosa. Inflorescentiae axillares, brevissimae, 2florae, pedunculo incluso. Bracteae concavae, membranaceae. Flores parvi. Sepalum dorsale subobovato-oblongum, obtusum, intus subplanum, dorso convexum, apicem versus praesertim medio incrassatum, 3nervium, fere 0.3 cm. longum, 0.1 cm. latum. Sepala lateralia oblique oblonga, supra basin leviter falcatula, apice angustata, obtusa, intus subplana, extus medio valde convexo-incrassata, superne trigona, 3nervia, c. 0.3 cm. longa, 0.1 cm. lata. Petala oblique elliptica, obtusa, basi contracta, concava, dorso obtusangule convexa, 1nervia, c. 0.2 cm. longa, 0.1 cm. lata. Labellum basi gynostemio fere omnino adnatum, totum c. 0.26 cm. longum; lamina gynostemium longe superans, recurvula, cum gynostemio angulum faciens, recta, carnosula, supra visa oblonga, obtusangule obtusa, subtus convexa, supra subplana, canaliculata, in utraque canaliculi parte apice excepto incrassata, 3nervia, usque apicem ovarii c. 0.17 cm. longa, parte libera c. 0.13 cm. longa, 0.12 cm. lata; calcar reversum, incurvulum vel pressione rectum et ovario adpressum, scrotiforme, basi contractum, subtus canaliculatum, c. 0.13 cm. longum, 0.125 cm. latum. Gynostemium fere tota longitudine labello adnatum, latius quam longum, dorso convexum, fere 0.075 cm. longum. Anthera cucullata, ambitu late ovato-triangula, in rostrum membranaceum latum truncatum producta, c. 0.07 cm. lata. Pollinia 4, subsemiglobosa, introrsum excavata. Ovarium c. 0.15 cm. longum. Capsula sessilis, ovalis, c. 0.4 cm. longa, 0.26 cm. diam.

Sumatra: Benkoelen, Goenoeng Dempoe, 2000 m. (Exp. E. JACOBSON, AJOEB n. 485, August 1916).

This much resemble *M. brevifolius* J. J. S. but the lamina of the lip is not dilated towards the tip with incurved margins.

It is a curious fact that the species of *Microsaccus* often grow together with species of *Adenoncos*. This has been stated as well in Java as in Sumatra. *M. dempoensis* grew together with *Adenoncos virens* Bl. ; the plants were even collected under the same number.

Description from very few plants preserved in alcohol.

Microsaccus ampullaceus J. J. S. n. sp.

Caulis dependens, ramosus, apicibus incurvus, viridis, dense foliatus, ad c. 9 cm. longus, cum foliis ad c. 2.3 cm. latus, basi tantum radices tenues emittens. Folia subpatentissima, lateraliter compressa, oblique oblongo-triangula, leviter acuminata, acuta, lateribus convexa, basi supra breviter fissa, viridia, c 1.2 cm. longa, fere 0.4 cm. alta; vaginae tubulosae, lateraliter compressae, apice obliquae, virides, internodia superantes. Inflorescentiae axillares, brevissimae, biflorae, pedunculo abbreviato, nonnullis vaginulis latis teneris pellucidis albis apice virescentibus in bracteas vergentibus donato. Bracteae ovarium superantes, conduplicato-concavae, superne carinatae, acutae, colore vaginularum, ad c. 0.34 cm. longae. Flores parvi, carnosuli, nivei, c. 0.5 cm. lati, 0 475 cm. longi. Sepalum dorsale erectum, ovarium continuum, linearioblongum, apice vix dilatatum, obtusum, interdum minute apiculatum, utrinque convexum, intus inconspicue sulcatum, c. 0.275 cm. longum, 0.075 cm. latum. Sepala lateralia subpatentissima, plus minusve reflexa, basi vix torta, oblique lineari-oblonga, obtusa, basi tenui paulo dilatata ad calcar decurrentia, leviter concava, dorso incrassata et praesertim apicem versus subcarinata, sectione transversa triangula, c. 0.25 cm. longa, basi 0.1 cm., medio 0.06 cm. lata. Petala patentia, labello adpressa, oblique ovalia, obtusa, concava, dorso convexa, cum costa media dorso superne convexo-incrassata, c. 0.24 cm. longa, 0.13 cm. lata. Labellum a dorso compressum, subtus visum urceolatum, subtus longitudinaliter sulcatum, omnino niveum, totum c. 0.37 cm. longum; lamina dimidio inferiore gynostemio adnata, calcar continua, ambitu quadrangula, truncata, vix retusa, canaliculata cum sulco longitudinali et lateribus convexis, carnosa, c. 0.15 cm. longa, 0.13 cm. lata; calcar valde dilatatum, ambiti suborbiculare, sulco retusum, c. 0.225 cm. latum. Gynostemium cum anthera labello vix brevius, a dorso compressum apice valde dilatatum, dorso convexum, c. 0.15 cm. longum, apice fere 0.1 cm. latum, clinandrio transverso, concavo, margine postico rotundato-truncato erosuloque. Anthera cucullata, rotundato-triangula, apice incurvulo obtusa, connectivo gibbosoincrassato, alba, c. 0.07 cm. lata. Pollinia 4, obovoideo-ovalia, dilute flava, cum stipite cuneato antice convexo albo et glandula lineari alba c. 0.08 cm. longa. Rostellum patentissimum, rectangule incurvum et parte superiore in lacinias 2 subulatas partitum. Stigma transversum, latum. Ovarium album, c. 0.3 cm. longum.

Sumatra: Palembang. (F. M. ENDERT, liv. pl. cult. in Hort. Bog. sub n. 32).

This species is at once distinguished by the very broad spur, which is abruptly contracted in the lamina.

Description from living specimens.

Microsaccus albovirescens J. J. S. n. sp.

Caulis elongatus, dense foliatus, pars adest c. 15 cm. longa, cum foliis 1.4 cm. lata, internodiis c. 0.2—0.25 cm. longis. Folia patentia, lateraliter compressa, oblique oblongo-triangula, oblique acuminata, acuta, lateralibus convexa, c. 0.65 - 0.7 cm. longa, 0.3—0.325 cm. lata; vaginae internodia superantes, tubulosae, lateraliter compressae, apice obliquae. Inflorescentiae brevissimae, biflorae, pedunculo abbreviato, vagina incluso, nonnullis vaginulis in bracteas vergentibus donato. Bracteae patentes, subtriangulae, acuminatae, acutae, concavae, tenerae, c. 0.25 cm. longae. Flores bene 0.4 cm. lati, 0.55 cm. longi. Sepalum dorsale erectum, ovarium continuum, anguste obovato-oblongum, obtusum, leviter concavum, dorso ad apicem leviter incrassatum, 1nervium, c. 0.25 cm. longum, 0.075 cm. latum. Sepala lateralia patentia, divergentia, supra basin falcato-incurva, margine antico supra basin in lobulum obtuse triangulum dilatata, parte antica recta, lineari-oblonga, obtusa, concava, dorso valde carinato-incrassata, c. 0.23 cm. longa, 0.06 cm., supra basin 0.13 cm. lata. Petala parva, erecta, gynostemio et labello adpressa, oblique subelliptica, obtusa, basi leviter contracta, concava, 1nervia, c. 0.175 cm. longa, bene 0.075 cm. lata. Labellum longe calcaratum, rectum, totum c. 0.45 cm. longum, lamina usque medium gynostemio adnata, gynostemium paulum superans, quadrangula, apicem versus angustata, rotundato-truncata, carnosa, valde concava, subtus convexa, c. 0.15 cm. longa; calcar reversum, ovario parallelum, rectum, bene a dorso compressum, infra apicem leviter angulato-dilatatum, apice angustatum et altius obtuse bilobulum, fere 0.3 cm. longum, 0.16 cm. latum. Gynostemium breve, apicem versus dilatatum et late rotundatum, dorso convexum, clinandrio excavato, margine inferiore rostello arcte reflexo prominente. Anthera cucullata, peculiaris, antice visa triangula basi utrinque rotundata, apice lata tenuisque, connectivo antice in gibbum conspicuum porrectum obtusum subverruculosum apicem antherae aequans et cum eo angulum faciens producto, c. 0.05 cm. lata. Pollinia 4, suboblique obovoidea, stipite cuneato, supra basin recurvo, antice convexo, apice inflexo 2lobulo, glandula longa, anguste lineari, paulo a latere compressa. Rostellum reflexum, medio incurvum, gynostemium aequans, in lacinias subulatas bifidum. Stigma obverse triangulum. Ovarium rectum, c. 0.375 cm. longum.

Sumatra: Craterwall of Manindjau-lake, 600—800 m. (E. JACOBSON, cult. sub n. 682).

In its habit this much resembles *M. canaliculatus* J. J. S. from the same spot. It has, however, acute leaves, different sepals, the lip narrowed to the apex and not retuse, a longer spur and a curious anther. The colour too is different.

„Bract diaphanous white, ovary white, sepals, petals and lip white with the apical half light greenish yellow, the lip with a light green nectary, spur white." (E. JACOBSON).

Description from materials preserved in alcohol.

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H. CAMMERLOHER.

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STEARINSÄURE IM MILCHSAFT VON FICUS FULVA REINW.

von

A. J. ULTÉE.

In einer früheren Mitteilung [1]) habe ich über das Vorkommen eines wachsartigen Körpers im Milchsaft von *Ficus elastica* ROXB. und *Castilloa elastica* CERV. berichtet, der sich aber in so geringer Menge fand, dass vorläufig von einer eingehenderen Untersuchung abgesehen werden musste. In der Hoffnung, dass andere *Ficus*-Arten reichlichere Mengen dieses oder eines verwandten Wachses liefern würden, unterzog ich ihren Milchsaft einer näheren Untersuchung.

Bei *Ficus Vogelii* MIQ. [2]) war das Resultat negativ, obwohl im koagulierten Produkt 25 % Harz vorkommen; dagegen erwies sich bei *Ficus fulva* der Wachsgehalt als so hoch, dass eine nähere Untersuchung möglich schien.

Am Ostabhang des Tengger-Gebirges (Ostjava) traf ich ein Exemplar einer mir unbekannten *Ficus*-Art an, die mir Dr. SMITH, Direktor am Herbarium des botanischen Gartens in Buitenzorg, in liebenswürdigster Weise als *Ficus fulva* REINW. determinierte.

Auf die übliche Weise wurde der Saft aus dem Stamm gewonnen und auf der Stelle mit Alkohol koaguliert, wodurch ich ungefähr 12 g. des lufttrockenen Produktes erhielt. Der Feuchtigkeitsgehalt desselben betrug 1.35 %.

Um das Wachs darzustellen, wurde das Produkt so oft mit der 50-fachen Menge Alkohol ausgekocht, bis nichts mehr in Lösung überging.

Nach viermaliger Extraktion blieb ein in Alkohol unlöslicher Rückstand übrig, der 7.7 % des Ausgangsmaterials ausmachte. Es gelang, mittels Benzol einen Teil dieses Rückstands in Lösung zu bringen, aus der durch Alkohol Kautschuk gefällt wurde. Da dieser Niederschlag nur 1.1 % des ursprünglichen Produktes betrug, ist der Milchsaft von *Ficus fulva* somit sehr arm an Kautschuk. Der in Benzol unlösliche Rückstand (6.6 %) besteht aus Eiweiss, Salzen und Verunreinigungen, die beim Abzapfen in den Latex kamen.

Aus dem alkoholischen Extrakt setzt sich bei Abkühlung der grösste Teil des in Lösung gegangenen Wachses ab; ich erhielt resp. 2.8, 2.5,

[1]) Chem. Weekbl. *9*, 773; (1912).
[2]) Ber. Chem. Ges. *54*, 784; (1921).

1.9 und 0.9 g, die die Schmelzpunkte 52—55, 52—55, 52—55 und 56—58° zeigten. Durch Eindampfen der gesamten Mutterlauge auf 1 Liter erhielt ich noch 0.95 g eines in Alkohol schwer löslichen Produktes mit dem Schmelzpunkt 47—50°. Im ganzen gewann ich also 8.35 g Wachs, sodass der Milchsaft sehr reich an diesem Bestandteil ist und demgegenüber die Kautschuk-Menge ganz in den Hintergrund tritt.

Das Wachs wurde mit alkoholischem Kali verseift, indem es so lange auf dem Wasserbad erhitzt wurde, bis alles aufgelöst war. Dann wurde der Alkohol abdestilliert, der Rückstand mit Wasser gewaschen und gut getrocknet. Durch Extraktion mit trockenem Benzol ging das eine Spaltungsprodukt des Wachses, der hochmolekulare Alkohol, in Lösung, das Kaliumsalz der Fettsäure blieb zurück.

Der durch Verdampfen des Benzols erhaltene Alkohol wurde einige Male aus Aethylalkohol umkristallisiert, schmolz dann noch nicht scharf zwischen 199 und 203° und gab die Phytosterin-Reaktionen von SALKOWSKI und LIEBERMANN. Eine eingehendere Untersuchung wird erst möglich sein, bis es gelingt, mehr Milchsaft zu erhalten.

Das Kaliumsalz der Fettsäure wurde in verdünntem Alkohol gelöst, dann mit Salzsäure angesäuert und die ausgeschiedene Fettsäure in einem Becherglas auf dem Wasserbad herausgeschmolzen. Nach Abkühlung erstarrte diese zu einem schwach gelben Kuchen, der getrocknet 40 % des Ausgangsmaterials ausmachte. Durch Umkristallisieren aus 75 %igem Alkohol wurden schon binnen kurzem konstant schmelzende, glänzende Blättchen, S = 69°, erhalten.

Der Schmelzpunkt ist somit identisch mit dem der Stearinsäure.

Dass tatsächlich Stearinsäure dargestellt wurde, ergibt sich aus folgendem:

1) Bei Mischung mit reiner Stearinsäure wurde keine Schmelzpunkt-Erniedrigung konstatiert.

2) 0.2144 g Sbst. verbrauchten zur Neutralisation (Phenolphthaleïn) 5.7 cm^3 0.1306 n. Natron. Gef. Mol. Gew. 288, ber. 284.

3) 0.1636 g Sbst. 0.4560 g CO_2, 0.1920 g H_2O.

$C_{18}H_{36}O_2$ Ber. C 75.98, H 12.76.

Gef. „ 76.02, „ 13.13.

Stearinsäure wurde bisher nur selten in Milchsaft angetroffen. WINDAUS und WELSCH [1]) fanden sie in geringer Menge in Antiarharz, aus *Antiaris toxicaria* LELCH. Das merkwürdige bei *Ficus fulva* ist das reichliche Vorkommen dieser Säure.

Stearinsäure wurde ferner noch kürzlich aus dem Milchsaft eines Pilzes, *Lactarius veleteus* TR., durch ZELLNER [2]) dargestellt.

Schliesslich sei noch betont, dass das Wachs von *Ficus fulva* nicht identisch ist mit dem von *Ficus elastica*.

[1]) Arch. Pharm. *246*, 504; (1908).
[2]) Ref. Chem. Z. Bl. *93*, Band I, 632; (1921).

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A CONTRIBUTION TO THE STUDY OF THE OIL PALM, ELAEIS GUINEENSIS JACQ.

by

CECIL YAMPOLSKY.

Introduction.

The oil palm, *Elaeis guineensis* JACQ., is a native of Africa and it has been exploited by the natives and Europeans for the commercial products palm and kernel oil. The oil is secured from the fruit, the pericarp yielding the so-called pericarp oil, the kernel yielding kernel oil. The fruit has received the greatest amount of attention. Although countless publications on the varieties of the oil palm have appeared no work of a morphological, anatomical or physiological character has been done.

The extension of the oil palm culture on an extensive scale in the Dutch East Indies and especially upon the East Coast of Sumatra has created an interest in the plant which included a program for a complete morphological, anatomical, histological and physiological investigation of the plant.

The work was begun at the „Algemeen Proefstation der A. V. R. O. S." in Medan (Sumatra) and later transferred to Buitenzorg under the auspices of the „Departement van Landbouw".

Circumstances have prevented the completion of the program that had been mapped out and it is hoped that the gaps left in this work will in the near future be closed up.

I wish to express my indebtedness to Dr. A. A. L. RUTGERS, Dr. P. J. S. CRAMER, Dr. W. DOCTERS VAN LEEUWEN, Dr. C. F. VON FABER, Dr. I. BOLDINGH for their cooperation in furthering this work.

Medan, Sumatra.
Buitenzorg, Java.

The development of the leaf in the oil palm.
(*Elaeis guineensis*, JACQ.)

The palm leaf has been an object of investigation for almost a century. Since DE CANDOLLE (4) in 1827 up to the present, a fairly large list of titles has appeared on the subject and the concensus of opinion of the various investigators has been that in the formation of the segments of the fan-palm leaf and in the formation of the leaflets of the pinnate leaf, essentially the same process goes on, namely that the parts of the leaf blade originate from an originally undivided leaf blade. How the ultimate act occurs resulted into split camps — adherents of VON MOHL's (22) interpretation and, in more modern times, the point of view advocated by GOEBEL (9) adapted from HOFMEISTER (14). The field has narrowed down to those who believe with VON MOHL that segments in the palm leaf arise as a result of the formation of slits in the respective halves on either side of the rhachis and of those who believe with GOEBEL that in the palm leaf the segments arise as a result of folding of the young leaf blade owing to the limited space which it has for development. GOEBEL's point of view has had preeminence and it is the conventional interpretation that one meets in text books and in semi-popular scientific treatises.

Historical.

The historical development of the idea of palm leaf formation has been dealt with in detail in the works of VON MOHL (22), NAUMANN (23), and DEINEGA (6), so we shall not enter into a full discussion of it here.

DE CANDOLLE (4) observes that in young palm plants the leaves are entire and that later they begin gradually to tear, beginning at the upper end. This, he maintains, is a natural phenomenon — the cause of the phenomenon or mechanism which determines this rupture is difficult to assign.

VON MOHL (22) we feel justified in quoting more or less in detail since he was really the first to give a fairly complete picture of palm leaf development.

The leaf arises as a blunt excrescence from the growing point. As this excrescence begins to develop it lifts itself above the plane of the growing point and there is a very early indication of differentation of parts of the leaf.

The development of a pinnate leaf from a simple leaf in the palm is unique. DE CANDOLLE states, in his "Organographie", that division of the palm leaf into pinnae or into segments of the fan leaf occurs in a characteristic fashion, namely through tearing. DE CANDOLLE evidently had made his observations on somewhat older leaves. VON MOHL found that the separation of the leaflets occurred long before the ultimate unfolding of the leaf. He observed that the leaflets are held together by a loose parenchyma which

is fused with the edge of the leaf into a narrow strip; that it is in close contact with the pubescence of the leaf and when the parenchymous strip and pubescence dry up and fall off, the leaflets are set free. VON MOHL made his observations upon *Phoenix* and *Cocos flexuosa*. In the young stages the leaves of the plants (up to 5 mm.) consist of a homogenous tissue. The middle, which later gives rise to the petiole, is thicker and the blade is comparatively thin at the edges. Later a flat furrow arises between the thickened mid-rib and the leaf edge. In later stages this leaf lamina shows closely packed, rather deep, horizontal furrows and the leaf blade is yet undivided. Still later these horizontal furrows develop into slits which in *Cocos flexuosa* run through to both surfaces so that they can be seen on the dorsal and ventral sides. Subsequent stages show that a leaflet develops between every two slits A longitudinal or cross section shows that the leaflets are folded in two. In *Cocos* the mid-ribs of the leaflets are on the dorsal surface so that the ventral surface of the leaf has twice the number of slits. The edge of the leaf into which the ends of the leaflets fuse is in the form of a continuous cell tissue (the edge of the unsegmented lamina). This tissue dries up as the leaf continues to develop and is thrown off as brown threads thus releasing the leaflets. In *Phoenix* the conditions are somewhat different since the mid-ribs of the leaflets are on the ventral surface and the tissue which holds the leaflets together at the edges is continued into rather a thick membrane on the upper surface of the leaf so that the slits are visible upon the ventral surface only The leaf then arises as a homogenous mass and the leaflets owe their [illegible] to an actual division of the leaf blade. This division does not begi[illegible]om the edge towards the mid-rib but is limited to the blade surface and does not touch the edge and in *Phoenix* the dorsal surface remains undivided [illegible]he undivided part of the leaf blade differs from a true pubescence in its [illegible]ode of origin inasmuch as it is not an outgrowth of the upper surface but an actual part of the original leaf tissue. In *Phoenix* (not in *Cocos*) vascular bundles traverse this undivided part of the leaf blade.

TRECUL ([36]) observed in *Chamaerops humilis* that the very young leaf is enveloped by a sort of pellicle. By removing this pellicle he found underneath, both surfaces in the form of divided and parallel ridges. The lobes on the sides are always shorter than the others but they gradually attain the same length as the others. The author does not attempt to explain the origin of the leaflets or segments.

In speaking later of the pellicle the author says: "One can recognise the presence of this envelope in very young leaves at the time when the grooves between ridges during growth in length of *Chamaedorea martiana*, for example, appear. The leaves appear to develop in a translucent gelatinous substance which gives rise to the pellicle. In *Chamaedorea* it seems to persist on the surface of the leaf following its contours during formation — constituting for the leaf an epidermis or kind of cuticle."

HOFMEISTER ([14]) in a very brief discussion of the palm leaf says the following: "In all palms each leaf during its development is tightly enclosed in the sheath of the next older leaf. The lamina of the leaf is closely pressed in this conical space. In palms with pinnate leaves (*Phoenix dactylifera*) both halves of the lamina are arranged in folds which lie at right angles to the long axis of the leaf. In fan palms *(Chamaerops humilis)* the leaf blade is folded to correspond with the number of segments in the mature leaf."

Separation of the leaflets in the pinnate palm, in the compound leaf (*Caryota*) or partial separation of the segments of the fan palm results from the death of definite tissue between the segments causing complete or partial liberation of the segments.

GOEBEL ([9]) in his general dicussion in "Vergleichende Entwicklungsgeschichte der Pflanzenorgane" presents his contribution to the study of palm leaf development: "The parts of the leaf blade are not the result of branching of the leaf blade but arise from the division of the blade into definite segments following the death of the tissue which holds these segments to-gether."

GOEBEL investigated *Chamaerops humilis* (macrocarpa) and *Phoenix reclinata.*

"Young leaves of *Chamaerops* show parallel ridges on both sides of the leaf — the ridges on one side alternate with the ridges on the other. This is the first indication of the longitudinal folding of the leaf which one can see more clearly in a cross section of a somewhat older leaf." GOEBEL states that the segments are set free as a result of the death of tissue between the segments. The folds of the leaf do not reach as far as the periphery of the blade. It is characteristic in young leaves that the segments are not free. They are enveloped by a many-layered sheath which can be removed and which is continuous with the base of the leaf blade. The sheath *Chamaerops* and *Phoenix* is the so called ligula. This ligula is not present in all palms. In palms (without ligula) the folds in the young stages are free and the sheath which later envelops them is a secondary outgrowth.

"Woher nun diese Haut stammt, habe ich, wegen Mangel an Material nicht feststellen können, sie kann durch innige Verwachsung der oberen Theile der Blatt-falten oder durch Verwachsung derselben mit dem eingeschlagenen Blattrande resp. einer Wucherung derselben, oder durch Verwachsung mit einer von der Blattbasis der sich entwickelnden Schuppe entstehen etc."

EICHLER ([8]) investigated both great groups of palms, fan and pinnate leaved. In the first group he investigated *Pritchardia filifera* HORT., *Livistona australis* MART. and *Chamaerops humilis* L. In the second group he examined *Phoenix spinosa* THONN., *Caryota urens* L., *Cocos Romansoffiana* CHAM. and *Chamaedorea oblongata* MART.

In *Pritchardia* the initial stages correspond with those of other investigators. Then immediately as a result of accelerated growth in width folding occurs, visible as a number of furrows on the inner and outer surfaces of

the lamina. These folds do not, however, run to the edge of the lamina. They disappear and the edge of the leaf is seen as a continuous unfolded strip. Partial separation of the segments results from the drying up of definite tissue when the leaf is 1 cm. long. This process begins at the apex and proceeds to the sides of the leaf.

The steps in *Livistona* are the same as for *Pritchardia.*

Chamaerops differs from the other two only in the manner in which the segments partially separate from each other. This occurs through the degeneration of the cells — they become mucilaginous. The tissue of the lamella that remains intact forms an epidermis around the ends of the segments where separation had taken place.

In *Phoenix spinosa* after the initial stages of leaf development, folding of the lamina occurs much in the same manner as described for *Pritchardia* — a strip at the edge remains unfolded — the folds, however, run horizontally instead of vertically as in other forms — the fan palms. Separation of segments occurs when the leaf is $^1/_2$ cm. long by a process of disorganization which begins at the unfolded edge and progresses towards the middle of the leaf. The rest of the forms show only slight variations.

NAUMANN ([23]) investigated *Phoenix leonensis*, *Ph. acquinoctialis*, *Ph. reclinata* and *Ph. dactylifera*. Separation of the pinnate palm leaf is a result of splitting in the halves of the blade.

"Der eigentlichen Spaltenbildung welche durch auseinander weichen von Zellen erfolgt, geht eine Art Wulstbildung voran, ähnlich wie bei der Entwicklung zusammengesetzter Blätter der Dicotyledonen; doch scheinen Wülste und Spalten bei *Phoenix* ziemlich gleichzeitig aufzutreten, da die Querschnittsbilder mit dem Wülsten zugleich auch Spalten zeigen."

NAUMANN's observation differs from VON MOHL's inasmuch as he describes the appearance of "Wülste" or swellings in association with slits. The slits do not run as far as the periphery of the blade. There remains a smooth strip around the periphery. NAUMANN maintains that the space relations between successively developed leaves is not so close as to cause pressure. The space between two developing leaves is filled with a very fine hair tissue. NAUMANN's observations lead him to combat GOEBEL's idea of a secondary tissue which envelops the folds of the blade after folding has taken place. According to his observations the enveloping tissue (Haut) is a part of the leaf and not an accessory product. NAUMANN states that the number of slits increases with the growth of the leaf; development is basifugal.

The other pinnate palms that NAUMANN investigated conform in the main to the observations cited above. In the fan palms NAUMANN finds practically the same conditions as in the *Phoenix* species. "Auch bei den Fächerpalmen gilt nach meinen Untersuchungen dasselbe, was ich bei den gefiederten an *Phoenix* gezeigt, dass die gefaltete Blattspreite durch eine mechanische Faltung nicht zu Stande kommt. Auch hier treten Wülste auf welche,

verbunden mit nachheriger Spaltenbildung, an der Spreite die in Fig. 18 angedeutete Faltung erkennen lassen."

With reference to the ultimate separation of the leaflets, NAUMANN says that it does not always occur, as EICHLER maintains, through a disorganization process beginning at the periphery and working inwards, but may result from the separation or growing apart of cells between segments.

DEINEGA ([6]) does not add anything new to the conception of palm leaf development. The part devoted to the palm leaf is a substantiation of GOEBEL's point of view and a polemic against NAUMANN. The inadequacy of the figures does not lend force to any of his contentions. The crucial point in the GOEBEL interpretation, namely the development of the secondary enveloping tissue around the folds after folding has occurred is discussed but no convincing proof is given. DEINEGA certainly did not have enough material available to study all the stages.

It had not occurred to me that the material at my disposal would offer anything essentially new other than the formal description of leaf development in a palm which has pinnate leaves. As the work progressed, however, it became apparent that the last word had not been said on leaf development and that *Elaeis guineensis* did not fall in line with either one of the interpretations that of VON MOHL and NAUMANN who attribute the partial or complete separation of the parts of the leaf blade to splitting of the originally intact blade surface, nor did it fall in line with the interpretation of GOEBEL, namely, that the leaf blade folds due to the limited space it has for development and separation occurs through disintegration of tissue between the folds.

Material and Methods.

The work was begun in Medan, Sumatra, at the „Algemeen Proefstation der A. V. R. O. S." where all stages for investigation were available. Not only were the plants growing there used but the oil palm plantations on the East Coast of Sumatra also served as sources of supply for materials needed. Later the work was transferred to Buitenzorg, Java, where additional material was available. The investigations on the leaf were made with seedlings in all stages and with trees up to five years of age. Observations were made both on living and fixed material. For studying the living material a Zeiss binocular was employed. For fixing material Juels solution was used and staining was done with iron-haematoxylin.

General discussion of leaf.

As in all palms the first leaves of the young plant are undivided. The transition from the undivided first leaves to the fully mature divided leaf is a gradual one. The first leaves (5 to 7 as a rule) are lanceolate with fairly strongly developed ribs Due to the strongly developed sheath

which encloses the next succeeding leaves, the first leaves have the tendency to be tubular. As growth increases, the outermost leaves are reflexed and they become concavo-convex due in a great measure, as we shall see later, to the fact that the segments which go to make up these leaves are held together in a definite fashion. As the young plant continues to grow the succeeding leaves increase in size and the first indication of the splitting of the leaf occurs, usually at the tip which becomes two-parted. With each succeeding leaf the progressive division of the leaf continues so that at the base of the formerly undivided blade a pair of leaflets appear. In the next succeeding leaves the number of pairs of leaflets increases. The end of the leaf except for its divided tip retains its more or less undivided character. In plants as old as two years this juvenile character of the leaf is still retained although the number of pairs of leaflets has increased. The following observations taken on plants in the „Cultuurtuin" (Experiment Garden) at Buitenzorg give the distribution of the leaflets according to the ages of the plants.

Age of Plant	Number of leaflets in pairs	Tip		
		undivided	divided	segments free
from germination to about 6 mos.		+		
6 mos.	0—2		+	
12 „	4—10		+	
18 „	14—20		+	
2 Yrs.	12—30		+	
4 Yrs.	130—160 (Sum.)			+
5 Yrs.	130—150 (Java)			+

It is interesting to note that in many of the juvenile leaves separation of the leaflets is incomplete. The separation begins at the midrib and progresses part way towards the periphery. It is not uncommon when going through a planting of seedlings to see leaves perforated in a manner characteristic of some Aroids.

The maximum development of the leaf occurs in the fifth year in Sumatra and the pairs of leaflets vary in number from 130 to 160 judged from the several countings that have been taken. In other countries, notably in the African districts where the oil palm naturally grows, the full maturity of the leaf is reported to occur when the plant is seven years old and when there is a marked upward growth of the stem.

The transition from the small leaf to the adult one, in some cases over 4 meters in length, is, however, gradual when one considers that it takes from 5 to 7 years for the maximum development to occur. The massive mature leaf with its long rhachis and many leaflets, with its petiole flexible and strong, tapering into a fine line towards the free end and at the opposite end merging into the leaf base and enveloping sheath is distinctly, in its outward appearance, a completely metamorphosed organ when compared with the juvenile leaf. The serrated edges of the petiole of the divided leaf in the form of sharp teeth together with the sharp spines, a result of the abortion of the leaflets formed at the base of the leaf blade, are entirely lacking in the very first leaves.

The length of time that it takes a mature leaf to develop from its initial formation to its emergence and unfolding can be approximately determined. This is done by determining the average number of leaves that are produced per year per tree. BÜCHER and FICKENDEY ([3]) state that in the Kamerun 12—20 leaves are produced per year. MAAS ([20]) estimates the average in Sumatra to be 20—24. A five year old tree growing in the „Cultuurtuin" at Buitenzorg showed, exclusive of the crown leaves, 60 leaves in various stages of development counting as the oldest leaf the one which would have unfolded next in the normal course of events and the youngest? as the last leaf developed from the growing point. On the basis of 20—24 leaves produced annually, it takes from $2^1/_2$ to 3 years for a leaf to develop beginning from the time that it is differentiated from the growing point to the time that it is ready to emerge.

Investigations.

Dissecting out the growing point of the plant offers no difficulties. This can readily be done with the aid of a dissecting microscope. Figure 29 plate IV represents the growing point dissected out from a two year old plant. Seen from above the growing point is ovoid in shape, the surface convex and the highest point in this view is somewhat eccentric, designated by the somewhat heavier shading. Presumably the next leaf is to be deliminated from that region. Figures 31 and 32 taken from prepared slides show the growing point, or perhaps better the growing hemisphere, to be of the same character as the one in the living condition.

In a longitudinal section, Figure 23, Plate III and Figure 37, Plate V, the more or less hemisperical condition of the growing region is seen. The cells of this growing region are cubical in form; the nucleus occupies the greater part of the volume. There is a periclinal arrangement of cell layers in the growing region, usually three or four layers. Beyond these layers — that is towards the interior of the growing region — there appears to be no regular arrangement of the cells, although they are distinctly embryonic in character as evidenced by the active cell division that is going on. The

nucleo-cytoplasmic relation in the cells of remoter parts tends more and more to become equalized. The growing point is not stationary as one can deduce from the $^3/_8$ arrangement of the leaves. How this rythmic shifting is brought about is hard to say. The newest leaf arises as an outgrowth or hook from the side of the growing region closely pressed against the side. There seems to be a receding of the growing region so that the highest point in the growing region lies almost opposite to the youngest leaf. This shifting in the growing point tends also to raise the growing region so that it always continues to maintain a definite level. The growing region always lies at the bottom of a hollow or depression, always of course protruding above the lowest level of the hollow. Figures 22 and 23 of Plate III which are longitudinal sections through a two year old plant, bring out very distinctly the relationship of the growing region and developing leaves. As the plant continues to develop the oldest leaves are thrown off and the growing region is shifted upwards so that in a very old tree the growing region is not distantly removed from the leaf crown.

The new leaf arises as a blunt hook-like protuberance from the side of the growing point (Fig. 37, Plate V and Fig. 23 Plate III). Viewed from above it is in the form of a crescent (Figures 29, 30, 31, 32, Plate IV). Growth goes on in several directions. The free ends of the crescent begin gradually to approximate one another so that ultimately they unite, completey encircling the leaf within. This portion of the developing leaf, as we shall see later, gives rise to the sheath. As soon as the ends meet, growth in a circle ceases. The ends coalesce and growth now begins upward. Simultaneously with this growth in a circle, the blunt hook begins to grow upward and to the sides so that very soon it has grown above the growing region bending over it in the from of a bonnet. This is very well shown in Figure 37, Plate V which represents a longitudinal section of the growing region and the three youngest leaves. The outermost leaf of the three in longitudinal section appears like a cone, the slit to the right showing where the leaf blade and the sheath approach one another. In the next two leaves the small protuberances to the right and to the left respectively are the developing sheaths. Bearing in mind the $^3/_8$ arrangement of the leaves it will easily be seen why a longitudinal section through a series of leaves gives so many different aspects to the leaf.

One can best visualize the subsequent processes of growth by imagining a cone with an inverted T cut into the surface, the longitudinal bar of the T reaching from the apex half way down and the horizontal bar half way around. Now if the flaps were turned back somewhat, they would represent the two parts of the leaf where the 'Anlagen' for the respective rows of leaflets develop. The opening in the cone represents the opening through which the apex of the next developing cone (leaf) appears. The disposition of the leaves of an oil palm in a young stage may very well be likened to a series of progressively smaller cones, the respective apices of which

penetrate in a definite relation with respect to the preceding or succeeding one, the side of the cone directly above it. One can also liken a developing leaf to an old-fashioned poke-bonnet (Figures 8 and 9, Plate II). In Figure 8 part of the sheath has been removed to show the conical character of the interior. The tip of the growing leaf coming in contact with the apex of the inner cone is deflected towards the slit.

The differentation of the leaf blade from the rest of the leaf can be readily seen in the very young leaves as a groove which runs parallel with the long axis of the 'Anlagen' for the leaflets (Figures 1, 2, 3, 4, 5, Plate I and Figures 8, 9, 11, 12, 13, 14, Plate II). In the juvenile leaves this groove is horizontal and in the mature leaves it is vertical or slightly oblique. This groove is seen before any of the leaflets are visible on the exterior of the leaf blade. The furrow marks the boundary between rachis and the rest of the leaf consisting of petiole, sheath and base.

Up to the present nothing new has been added to the development of the palm leaf other than a description of the processes that go on in the newly formed leaf of the oil palm. The stages which follow upon these are in the opinion of the writer, the critical ones. Differentiation of a pronounced character, at least visible differentiation, begins in the third leaf from the growing point. As has already been pointed out, the third leaf from the growing point has been differentiated into sheath, petiole, base, and leaf blade. Leaves in this stage, dissected out, show no outward evidence of differentiation going on within the leaf blade. It is only in prepared material that the changes can be observed.

Each leaflet arises from a mass of cells within the leaf blade and the indications point to their origin from single cells which are the 'Anlagen' for the leaflets. Figure 37, Plate V shows the outermost leaf cut in a plane which allows several of the 'Anlagen' to be seen. In this stage of development the 'Anlagen' can be seen as aggregates of cells, or cushions of cells, which are in an active state of division. As these aggregates continue to add on more cells they push the cells above ahead of them and this pressure exerted by these 'Anlagen' gives a wavy appearance to the layers of cells above them. A more detailed study of such an aggregate of cells is seen in Figure 38, Plate V. The aggregate of cells in this section is seen in the form of a more or less irregular circle, the center of which is occupied by a somewhat larger cell. The cells surrounding this larger one are in various prophase stages suggesting that a very active division is taking place. The outermost layer of cells, more or less cubical in form, is the upper epidermal layer of the young leaf blade. The next layer inward is also composed of cubical cells. The cells of these two layers are actively dividing. The cells of the lower epidermis are irregular although they too are actively dividing. The general impression is that these 'Anlagen' originate from single cells arising at the same level, cutting off cells toward the periphery of the leaf blade. The active division of the cells

of the remaining tissue keeps pace for the time being with cell division in the 'Anlagen' so that the developing leaflets do not in this stage of development penetrate beyond the other cells. They do however, as we stated above because of the application of pressure at regular intervals, give a wavy appearance to the cell tissue directly above them.

In a true longitudinal section of a leaf blade the number of visible leaflet 'Anlagen' would be multiplied. It is also quite evident, however, that not all the 'Anlagen' arise simultaneously. New ones are added basifugally.

Differentiation of tissue goes on rather early in the oil palm leaf. In the third leaf from the growing point the bast cells and bundle cells have begun to elongate and they can be seen in what is to be the base and petiole of the leaf. The growth of the 'Anlagen' goes on upward and to the sides, apparently also differentiation begins to occur, for in the very next stage, in the next following leaf, a definite epidermal tissue marks the peripheries of each growing leaflet. That is seen in Figures 39 and 40, Plate V; the wavy line of cells indicate the epidermal cells. In this fourth leaf from the growing point the leaflets are already in contact with each other and they begin to exert lateral pressure upon each other. It cannot be overemphasized that during the development of the leaflets they are enclosed in the tissue of the leaf blade and although marked growth and differentation has taken place in the leaflets, the leaf blade as a whole shows no outward indication of that fact. Figures 39 and 40 are different sections from the same leaf. Figure 39 is a cut through the tip of the leaf together with three developing leaflets; the split to the right of the drawing is part of the line formed by the approximating edges of the two halves of the leaf blade, such as one sees at the tip, for example in Fig. 12, Plate II. Here we see the distinct character of the tissue surrounding the leaflets. The cells are somewhat larger and longer and in Figure 40 they are seen with their long axes running in a different direction. This stage is important in view of GOEBEL, EICHLER and DEINEGA's assertions that the 'Haut' develops secondarily after folding has occured.

In Figure 41, Plate V we see a section through a leaf in still a later stage of development. This section has been cut so that it is more or less tangential, showing the ends of several developing leaflets. This section is interesting since it shows the character of the cells surrounding the leaflets. These cells are larger, the nuclei smaller in comparison with the rest of the cell.

More striking are the leaflets shown in Figure 28, Plate III. Here a section has been cut through a leaf showing at least twelve developing leaflets pressed closely against each other and enclosed within the tissue of that half of the leaf blade (see also Figure 22, Plate III, leaf HH). This section did not pass through the leaflets to show that splitting within the leaflets had already begun. Actual splitting, as we shall see, begins even in an earlier stage. It is in such stages that the evidence against the folding

theory of the leaf blade is strengthened. The leaflets have elongated considerably here and they are surrounded by an epidermal layer.

Splitting of the leaf 'Anlagen' to form the two halves of the mature leaflet occurs very early. It is possible that dissolution of the middle lamella causes the separation of the cells along the plane of the split. There is no evidence of any degeneration of cells suggesting a rupture along the plane of cleavage.

The leaflets are for a time sac-like structures. A longitudinal section of such a sac is seen in Figure 42, Plate V. The cells of the sac are in periclinal arrangement, five such layers can be counted in this leaflet. The outer and innermost layers are epidermal in character. The cells above and partially surrounding the leaflet are those of the enveloping tissue (the rest of the leaf blade). This is in the form of several parallel layers whose configuration conforms with the outline of the leaflet. Between the leaflet and the partial outlines of two adjacent leaflets are more cells of the enveloping tissue. In Figure 27, Plate III more of these leaflets are seen in relation to each other and to the rest of the leaf blade. Those near the apex of the leaf are seen clearly imbedded in the tissue of the blade; the others, because of the nature of the section, appear to be free. That, however, is not actually the case since in sections like the ones represented in Figure 28 which is from the next older leaf, the leaflets are still enclosed in the tissue of the blade.

The sac-like character of the young leaflet is also very well brought out in Figures 24, 25 and 26, Plate III. In Figure 24 the leaflets at the base show various stages of progressive splitting. Figure 25 is a part of a leaf, the fourteenth leaf from the growing point. Figure 22, Plate III, a longitudinal section of a two year old plant, shows the position of thirteen leaves. It must be remembered that the $^3/_8$ arrangement of leaves accounts for the differences between the sections. Starting with the lowest plane of the section we find the growing point in the form of a hemisphere, the youngest leaf a conical outgrowth directly over the growing point, the next leaf is represented by the two outgrowths to the left and to the right of the preceding leaf. In continuing upwards we find that each successive leaf is represented by one or two parts in this section. The corresponding parts of a leaf whenever they occur are designated by the letters AA, BB, CC, DD etc. Figure 23, Plate III is a longitudinal section through a two year old plant which does not yield as many developing stages. The leaves here are numbered 1—1, 2—2, 3—3 etc. The denser areas of the figures denote the meristematic regions of the various leaves. Returning now to the portion of the fourteenth leaf and bearing in mind the stage of development of the several leaflets shown in the twelfth leaf, figure 22, Plate III, we can readily see that not all the leaflets are in the same stage of development at the same time. This is also brought out in Figure 24 of the same plate. Here it must also be emphasized that the presence in the leaf blade of a region that is adding now leaflets argues against an assumption of folding of the leaf blade to form the leaflets.

Form of the developing leaflet.

In considering the form of the leaflet we must again return for a moment to the origin of the respective halves of the leaf blades. It must be remembered that they arise from that portion of the hook that grows over and above the growing region in the form of a bonnet, the edges of the bonnet representing the respective halves of the leaf blade. Then the appearance of the groove eliminates the leaf blade from the rest of the leaf. In cross section these leaf blades (the respective halves) are triangular, the leaflets arise from the base of the triangle which is the place of attachment of the leaf blade to the rhachis of the leaf. Whereas in the initial stages of development, as we have already seen, the leaflets are more or less sac-like in structure, their outline very soon begins to conform to the cross-sectional outline of the leaf blade — that is, they soon become triangular, flattened sacs (Figures 17, 18, 19, 20 and 21 Plate III).

The form of the developing leaflets cannot be explained without taking into account the changes of position that these undergo as a result of the development and growth of the other parts of the leaf and the special relation that exists between parts of the leaf.

The leaflets of what is to be the mature, fully divided leaf, arise as parallel outgrowths, in a more or less horizontal plane. This is seen from Figures 8, 9, 11, 12, 16, 17 and 18, Plate II, as well as from those in Plate III. A cross section through a leaf blade in a very early stage of development will show that to be true. Although the leaflets retain their parallel relation to each other, the plane in which they lie begins gradually to shift so that soon they are placed obliquely upwards. An examination of the section of a series of leaflets shown in Figure 24, Plate III brings that out. It also brings out the fact that the angles formed by the individual leaflets with the vertical axis differ, that the upper leaflets become more and more vertical and that between the lowest and the highest leaflets differences in degree of angle occur.

As a matter of interest it should be stated that shifting of the plane of position of the leaflets happens very early so that a cross section of a leaf in that stage of development will cut through two or more leaflets. This is important in view of the erroneous interpretation given to such sections by the older authors.

The shift in the position of the leaflets can be ascribed to the elongation of the rhachis, to the growth of the leaflets themselves, and to the pressure of the newly formed leaflets at the base of the leaf blades. The maintainance of the parallel arrangement of the leaflets is for the most part due to the common insertion of their apices in the tissue of the periphery of the original leaf blade, which structure still persists during such stages as shown in Figure 18, Plate II where the long strip of tissue to the right of the leaflets is the persisting strip of the young leaf blade.

It is seen also to the right of Figure 16, Plate II, and a portion of a blade with these leaflets held together by the strip is seen in Figure 17. Movement in growth of either rhachis or leaflets will affect the position of all the leaflets that are held together.

Figure 33, Plate IV is a cross section through a young leaf showing three pairs of leaflets in cross section. At first sight it would appear that folding of the respective halves of the leaf blade, as described by GOEBEL, has occurred. That, however, is not the case. The careful dissecting out of the various stages of developing leaves shows that that is an erroneous conception. The angular character of the leaflets is a result of mutual pressure of equally developing parts within a limited space. Figures 34 and 35 are somewhat later stages. Figure 35 shows the fairly undifferentiated leaflets which have already split, held together in part by the original enveloping tissue, the cells of which are seen running in a vertical direction. This stage seen alone might lend argument to the assertion that the "Haut" is a secondary development.

In the young leaf which is to give rise to the mature leaf of the 5 year and older trees, the 130 to 160 pairs of leaflets are closely packed together. Figure 18, Plate II is from a leaf of a five year old tree. A cross section through the upper part of such a leaf would cut through twelve pairs of leaflets. With the increasing growth of the leaves the space relations change so that the older leaves have more room for development and consequently the leaflets, as a result of released pressure, lose their angular configuration (Figure 36, Plate IV). It must always be borne in mind that these leaflets are still held together by the tissue of the periphery of the leaf blade so that in a cross section there is no apparent break between the leaflets.

Where the enveloping tissue of the growing leaflets is less resistant, the leaflets will ultimately break through. That occurs on the sides of the leaf blade. The apices of the growing leaflets are held together by the comparatively thick strip at the edge of the leaf blade which prevents, for the time being, the separation of the leaflets from the mother tissue along that line. The tissue on the side of the leaf blade surrounding the developing leaflets is comparatively thin so that very soon this tissue conforms to the outline leaflets due to the pressure of the several leaflets and we have the ringed appearance of the halves of the leaf blade recalling the outer segmentation of the earthworm. These are the "Wülste of NAUMANN ([23]) and folds of GOEBEL and EICHLER. Figure 16, Plate II shows the leaflets of one side of a blade in parallel arrangement. A larger magnification of such leaflets is seen in Figure 17, Plate II. Where the pressure from the enveloping tissue of the leaflets is released they take on a rounded form. With the increased growth of the leaflets the resultant pressure exerted on the sides of the leaf blade causes the tissue between each two leaflets to tear and we have then the formation of slits which

VON MOHL and later NAUMANN lay such great stress upon. To this we shall return in our general discussion. This tissue on the sides of the leaf with the slits torn into it, however, persists both on the outer and inner surfaces of the leaf adhering to the sides of the leaflet.

The sac-like character of the leaflet is soon lost as a result of the mutual pressure of the leaflets so that the sides of the sac approximate each other and lie closely pressed against each other much in the manner of a flattened out paper bag. Alteration in form is now due to growth in length, to pressure, to stretching and to differentiation that goes on within the leaflet itself. The various forms that the leaflet takes on are shown in sequence in Figures 16, 17, 19, 20, 21, 18, 15, 13, and 14, Plate II. One can readily piece together the history of the leaflet from the various aspects.

Figure 15 is a portion of a leaf of a two year old plant in the same stage of development as the leaf shown in Figure 14. It brings out very strikingly the fate of the strip of tissue which until final unfolding of the whole leaf holds the leaflets together.

It is difficult, at first, to visualize the process and I have found it best in an effort to get a clear picture of the steps that lead up to that structure, to bear in mind a mechanical contrivance which most closely approaches the relation of the leaflets and the strip which holds their apices together. This strip may be compared with the rod which holds the horizontal slats of a wooden shutter together and which, when shoved up or down, causes a synchronous movement of the slats. If instead of the wooden slats we replace them in our minds by triangular leaflets attached to the rhachis and we further replace the strip that holds the slats together, by the strip of tissue of the leaf blade, then we can readily visualize the relationship of parts in the leaf blade. And if further we can conceive that a pull exerted at the top of such a mechanism would stretch the undifferentiated strip much more than the leaflets which have during their differentiation been reinforced by the tissue developing within them, we have a fairly true picture of what happens to the undifferentiated strip which is subjected to the pull developed by the upward growing leaflets.

By carefully dissecting out the leaves, these prolongations (Figures 15, S, Plate II) can be readily recognized — they are the remains of the enveloping strip under discussion. These prolongations persist and at the unfolding of the leaf they are the last to separate so that for a time the leaflets, held together by their tips, appear to have been stamped out of a whole piece, the periphery of the leaf representing the remnants of the whole leaf blade.

The tips of the leaflets are made up of two distinct tissues — the tissue of the leaflet proper and the remains of the strip. This tip does not persist but dries up and falls off.

The rest of the enveloping tissue — the tissue that formerly surrounded the leaflets — persists until the leaf is ready to unfold. This tissue can be readily recognized because of its large cells. In dissecting out the leaflets it

can be seen adhering to the edges. It is represented by the dotted area to the right of the uppermost leaflet in Figure 15, Plate. II. Under the microscope these cells are recognised as being decidedly different from the cells of the leaf tissue, due to their larger size, their irregularity as a result of tearing during the process of slit formation, and by their thicker walls. These cells, persisting as they do, tend to keep the leaflets together and give them the appearance of having been folded together from a common leaf blade.

If we examine the distribution of the slits we find that there are twice as many on one side as on the other side, due, of course, to the fact that the splitting of the individual leaflets occurs uniformly on one side. In the upright position of the leaf these are on the outside since the morphologically upper side of the leaf is turned inward and only upon unfolding of the leaf and reflexing of the petiole does the morphologically upper side come to lie in its true position. That means, of course, that the midribs of the leaflets are formed on the inside of the developing leaf and later are found on the upper side of the leaf.

When the leaflets ultimately separate and the halves of the leaflets unfold along the split edge the force exerted in the process actually tears them apart with the result that the still persisting enveloping tissue gives a ragged appearance to the edges of the leaflets. As we have already pointed out, the development of an epidermal layer occurs almost simultaneously with the splitting of the leaflet.

In the oil palm, at least, there is no evidence for the assertion that definite parts of the tissue degenerate to liberate the segments. All the evidence points to a mechanical tearing of a persisting tissue — a tissue which is thrown off at a late stage of development.

Juvenile leaves.

At the beginning it was stated that the young oil palm, like all palms, shows an undivided leaf and that the transition from the undivided leaf to the fully divided leaf is a gradual one. The first leaves are lanceolate and, as a rule, the leaves show a divided character at the beginning of the sixth month. In Figure 106, plate XII a young seedling, still attached to the seed, shows the lanceolate leaves. There appears to be a strongly developed mid-rib and no indication of splitting. Another such leaf is seen in Figure 7, Plate I. It will be observed that at the base of the leaf, just above the tubular sheath, the ribs give a fluted appearance to the leaf blade.

The juvenile undivided leaf in its origin does not differ markedly from the fully mature leaf. It arises as a blunt protuberance from the side of the growing region. It then grows over the growing point developing into a bonnet-like structure. Differentiation of leaf blade begins by the formation of an horizontal furrow followed by the formation of segments in the very same manner as we have described for the mature leaf.

It will be remembered that in the mature leaf the furrow deliminating the leaf blade from the rest of the leaf runs more or less vertically. The initial stages are exactly like those described for the fan palms by EICHLER (8) such as *Pritchardia*, *Livistona* etc, where the furrow is horizontal.

It is comparatively simple to follow the various stages from the undifferentiated to the mature leaf. In the young stages which show no outward indication of the presence of 'Anlagen' for segments, their presence can be shown either by pressing a cover slip down gently and staining with a suitable dye or by partial maceration of the leaf and then observing it. As a rule the number of segments observed on either side of what is to be the mid-rib is five. That number however is not fixed. I have found 7 and 8 segments in each half.

The segments arise as individual units from 'Anlagen' and they maintain their individuality throughout. The same process, of splitting as described for the mature leaves results in a folded leaflet.

In Figure 1, Plate I the leaf represented is already in an advanced stage of development, the segments are definitely deliminated. It is to be noted that the segments here arise in a more or less horizontal plane. The leaflets do not reach to the periphery of the leaf blade, there is a comparatively thick undivided strip, much wider than we have noted for an equivalent stage that is to give rise to the fully divided leaf. The tip of the leaf is very strongly developed and the very apex ends in a number of branched hairs (Figure 2 Plate I). The presence of this comparatively thick strip no doubt is associated with the fact that no separation of segments occurs in the first leaves.

Further stages of development are seen in Figures 2 and 3. The leaf shown in Figure 2 has eight segments in one half of the blade, the one in Figure 3 has six. These segments, however, never separate but they are held together by the thick strip of tissue at the periphery of the leaf blade. The respective halves of the segments corresponding to the respective leaflets in the divided leaf, pass through the same splitting and they have the morphological equivalent of a mid-rib. The halves along the line of cleavage separate from each other. This process of splitting of the segments which is not followed by the separation of the segments from one another results in a lanceolate leaf which shows distinct folding where it is constricted and consequently the fluted appearance at the base of the blade to which we have already referred (Figure 7, Plate I). The formation of slits on the outer and inner surfaces occurs after the segments have exerted a pressure on the sides of the lamina causing splitting of the enveloping tissue between two segments, precisely in the same way that we have noted for the older leaf. At unfolding of the leaf however, the separation of the segments along adjacent edges does not occuur, as it does in the mature leaf. Following the fifth or seventh leaf splitting one division of the tip of the leaf occurs, a condition so very typical also for the coconut palm. Then follow leaves with a single pair of leaflets at the base of the blade more or less completely

separated from the rest of the blade. The later leaves show various gradations from the partially divided leaf to the one that is completely divided. The dichotymous appearance of the end segments due to failure of several segments to separate from one another continues well into the second year. From these stages it can readily be seen that what appears to be a mid-rib in the juvenile leaf is really not so. This mid-rib is morphologically equivalent to the rachis of the mature leaf and is therefore a true rachis.

The transition from a lanceolate undivided leaf to a divided or pinnate one is very interesting to follow in the young stages. Changes of a profound character take place in the young leaf. It is to be remembered that the leaflets or segments in the juvenile leaf arise from a more or less horizontal plane and those in the divided leaf from a vertical plane. In the transition stages from the juvenile leaf to the mature leaf there is a shifting of the plane of origin of the leaflets, so that it comes to lie almost in a vertical position. Figures 4 and 5 Plate I show such transition stages; they also show an increase in the number of segments or leaflets. The relatively wide strip still persists as well as the strongly developed tip. The older leaves develop successively more leaflets and that means more 'Anlagen'.

Figure 6 Plate I shows a young leaf taken from a seedling whose unfolded leaves showed no segmentation. This young leaf when mature would show at least 17 pairs of leaflets. With the increasing age of the plant, the leaves have more leaflets until the 5th to the 7th year, when full maturity of the plant is reached.

The striking alteration of leaf form from an outwardly undivided to a pinnate leaf, with the horizontal plane in which the segments of the former arise going over into the more or less vertical plane in which the latter leaflets arise, has an interesting parallel in the manner in which fan leaves and pinnate leaves arise. The fan palm leaf arises much in the same manner as the juvenile leaf, in an horizontal plane whereas the pinnate leaf arises in a vertical plane.

Sheath.

The sheath of the oil palm leaf is a conspicuous and persistent organ. It arises after the young leaf has been differentiated from the growing point and after the horns of the crescent shaped structure have grown around the next succeeding leaf ultimately enveloping it. Figures 29, 30, 31 and 32 Plate IV show various initial stages in the development of the ring. When the tips of the horns meet growth is deflected upwards and the sheath, as such, begins to develop. Only the gross features of development of the sheath have been followed in this study and it is by no means a complete study of this organ. The forms of the sheath in the later stages are shown in the several plates and they can be recognized as such without further explanations.

The line of demarkation between sheath and petiole and base is very sharp and it can be seen with the naked eye when young leaves are dissected out. This is due to the criss cross arrangement of the fibres and bundles of the sheath in contrast with the adjacent parallel and vertical arrangement of the fibres and bundles of the base and petiole of the leaf (Figure 12 Plate II and Figure 43 Plate VI).

In examining a sheath in a young stage shown in Figure 44, Plate VI, we find that the tissue at the unattached end of the sheath is composed of a layer of multicellular filaments in various stages of development. The filaments however can readily be traced back to where they are arranged in parallel rows. The fact that these rows of cells end at different levels gives the scalloped form to the free end of the sheath. Figure 45, Plate VI is a part of sheath taken from a stage shown in Figure 44 and shows the arrangement of the layers in position YY. The free ends of the parallel rows of cells terminate at different levels. Figures 46 to 50 show the various stages of development of these hair like structures. Figure 47 shows initial stages of growth of several of these hairs. The plane of division is not constant; it may be in a horizontal, vertical or oblique plane. The hairs are both branched and unbranched. The apical cell apparently is the one that is in active division. In the very early stages the cytoplasm of the cells filling the whole lumen is vacuolated containing tiny starch grains. The cells are colorless. As the hairs continue to grow they elongate and take on the form shown in Figure 51 Plate VI. In this stage the cytoplasm is seen bounding the periphery of the cells, the starch grains have disappeared and the cells begin to degenerate soon after. The above description refers primarily to the cells at the free end of the sheath.

On the inner surface of these sheaths and near the top may be found minute stomata apparently fully formed, however without any chlorophyll grains (Figure 52 Plate VI). It is questionable whether these ever function since they never reach direct light and therefore they must be regarded as rudimentary. They are about one fourth the size of the stomata of the leaf epidermis.

With increased growth of the leaf as a whole, the sheath increases in size; from the outer epidermis of the sheath as well as from the base of the leaf and petiole a dense felt like growth of hair arises, single or branched, similar to the hair shown in Figure 51 Plate VI. Between each succeeding leaf until the outermost leaves are reached this dense felty growth is present and it is only when this felty growth reaches the outside that it dries up and falls off. In the meantime the bast strands of the developing leaf become strengthened and more rigid so that when a stage shown in Figure 43, Plate VI is reached, marked changes have occured. The sheath has become tough and leathery and resistant to stress and tsrain. The criss cross weave of the fibres makes a most resistant tissue.

As the leaf begins to grow in length the sheath to-gether with the petiole push their way above the older leaves so that ultimately the top of the sheath is exposed and very soon thereafter begins to die and discolor beginning at the top and continuing gradually downwards. The ends become frayed out; the bast fibres held together more or less in strands give a ragged appearance to the sheath. The sheath shown in Figure 43, Plate VI is from a two year old plant. Several of the leaves have been removed as well as the felt to bring into prominence the sheath. The dark areas represent that part of the sheath tissue which has died and has become tough and leathery. The layer facing the inside which has not been so greatly exposed persists in a living condition for a longer time.

From the petiole of the leaf, to the right of Figure 43, the bast strands are seen emerging from the edges. These bast strands, however, come from these that run parallel upwards in the petiole and emerge from the petiole at different levels. In the maturer leaf where lignification has already occured they appear as a series of strongly developed saw teeth on either side of the petiole and always below the last pair of leaflets. Ultimately, due to the death of the enveloping leaves above the sheath it reaches the outside where its tissue dies completely and it persists for a long time lending support to the base of the leaf and thus aiding the leaf to withstand the severest strains.

Maturation of the leaf.

The processes of differentiation within the leaf beyond the formation of the leaflets and the young stages of the sheath, rachis, petiole and base, have not been embraced in the scope of the present work and no attempt has been made to view the steps in the light of the immense amount of work that has been done on palms as well as on other plant groups.

For the discussion of the special organs at the base of each leaflet which determine the position of each leaflet with reference to the rachis attention is called to the observations of RUDOLPH ([29]) "Zur Kenntnis der Entfaltungseinrichtungen an Palmenblättern". These organs (Polster) reach their maximum development after the leaf has emerged and has completely unfolded. The leaflets at the base of the leaf, abort in varying numbers, soon after the emergence of the leaf. The leaflet blade drops off and the mid-rib persists in the form of a sharp stout spine imbedded in this 'Polster'. These spines together with the saw teeth of the petiole (of quite a different origin) give an armed appearance to the leaf.

Lignification proceeds from the tip of the leaf downwards. If one examines a leaf that is emerging in the form of a spike one finds lignification of the rachis beginning at the tip and if one follows the leaf down to the petiole and base, which have not yet emerged, the tissue is still very tender and pliable, not resistant and very easily cut through with a knife.

The formation of wood goes on here coincident with the exposure of the leaf to the outside environment. The mature leaf is a highly resistant organ which can be subjected to the severest storms without separating it from the rest of the plant.

Discussion.

Although all the foregoing investigators have very amply discussed the literature of their time, it does not seem to me to be out of place, in the light of the evidence that has been advanced, to discuss the results of the older investigators from the point of view that has been submitted here.

The first critical work on the palm leaf was that of VON MOHL ([22]). It is truly remarkable, taking into consideration the comparatively primitive methods, that such good observations were made on leaf development. We have already summarized his observations in the historical part of this paper. Unfortunately VON MOHL's observations did not go back far enough from the stage that shows the appearance of furrows and slits. Between the appearance of the young undifferentiated leaf and the stage in which the furrows appear the critical stages are to be found. That too we have fully discussed. It has been pointed out that the furrows that VON MOHL described are really the developing leaflets within the leaf blade proper and that the furrows indicate the areas between adjacent developing leaflets It should be emphasized, however, that VON MOHL states that in this stage the leaf is yet undivided. It is, according to him, due to the development of slits that the division of the lamina occurs. The leaflets are ultimately set free by the drying up and falling off of the loose parenchyma which holds them together.

The undivided part of the leaf blade differs from a pubescence in its mode of origin inasmuch as it is not an outgrowth of the upper surface but an actual part of the leaf tissue. This keen observation of VON MOHL's, GOEBEL and EICHLER misinterpreted by stating that the undivided part of the leaf is a secondary structure.

TRECUL ([36]) speaks of a pellicle enveloping the very young leaf. When this is removed the parallel ridges on both surfaces of the leaf are seen. Trecul did not observe this pellicle in earlier stages. This pellicle according to him is a secondary development arising from a gelatinous translucent substance around the leaves. TRECUL's work did not contribute to the knowledge of the development of the palm leaf because he too did not have a complete series of stages under observation.

It was HOFMEISTER ([14]) who made the broad generalization that folding occurs owing to the limited space in which the young growing leaf develops. The separation of the leaflets results from the death of a definite tissue between the segments causing complete or partial liberation of the segments. This generalization has up to the present been accepted

by most botanists as the explanation of the origin of leaflets. It serves as the basis of GOEBEL's, EICHLER's and DEINEGA's work. It can readily be seen that HOFMEISTER made his observations on late stages where all the critical steps had long since happened and that his material consisted of already completely formed leaflets held to-gether by the enveloping tissue.

The name of GOEBEL ([9]) is always associated with the folding theory of the origin of leaflets. We have already quoted him and shall do so again for the sake of emphasis. "The parts of a leaf blade (palm) do not result from branching of the leaf but arise from the division of the lamina into definite segments following the death of the tissue holding these segments to-gether . . . . . ." If we examine the figures given as evidence of this phenomenon we find them unconvincing since there are so few of them. His Figure 44, *Chamaerops macrocarpa*, shows at a glance that he had at his disposal stages that were much too old and misleading when younger stages are lacking. Such stages are found in the young plants of the oil palm where the lanceolate leaves still persist in a more or less degree. Much earlier stages would have shown the unfolded character of the leaf together with the presence of developing leaflets within the leaf blade. GOEBEL's Figure 45 is as unconvincing as his other. His stage 1 of Figure 45 is not, in my opinion, a stage which shows folding but a stage where the leaflets have pressed against the enveloping tissue giving an appearance of folding and also resulting in a rupture of the tissue in the form of slits between adjacent leaflets. His stage 3 of Figure 45, a longitudinal section through the leaf blade, is too incomplete to lend much significance to it, whereas number 2 of the same Figure 45 is in reality a cross section of a leaf where the leaflets have oriented themselves obliquely upwards perhaps like the stages shown in Figures 34, 35 and 36 Plate IV of this paper.

GOEBEL's evidence for the formation of a secondary "Haut" which envelopes the folded lamina is entirely lacking and its origin is merely a conjecture on his part.

The evidence so far advanced for the theory of folding has been conspicuously meager. The first extensive contribution accompanied with figures was that of EICHLER ([8]). We have already summarized his work. Wheras the figures that he submits are extensive, he has failed in common with those who have preceeded him to focus his attention on the stages that yield the transition stages between the completely undifferentiated lamina and the one that shows folds. Judged from the stages given in his [illegible] plates the argument for folding is amply supported. We find, however, in all his series of stages given for the several forms, the intrafoliar origin of the leaflets not only not indicated but even not suspected. The assumption that between the individual leaflets definite tissue dies or degenerates to liberate them is in my opinion a gratuitous one based on inadequate observations on the origin of the leaflets, their growth, their orientation

through the shifting of the plane of growth. We have seen in the oil palm that these leaflets are separate units held together at their free ends by the strip at the edge of the lamina and by the thin, frayed and torn enveloping layer. A mere mechanical tearing of the strip at unfolding libérates these leaflets and inasmuch as the leaflets were for the most part always free no disorganization of definite tissue between them functions in a manner described by EICHLER. Certainly EICHLER's figures 11, 12, 13, 14 Plate I are not very convincing for the argument advanced. The same criticism holds for his figures in the other plates showing disorganization of tissues in the act of liberating the segments and leaflets. EICHLER's contribution is a substantiation of HOFMEISTER's and GOEBEL's interpretations.

NAUMANN's observations on a large number of forms deserve more credit than hitherto has been accorded them. His work is an amplification of that of VON MOHL and he was able to contribute much to our knowledge of the formation of the palm leaf. NAUMANN observed that before the appearance of the slits which VON MOHL describes, swellings occur and that after their appearance the slits become apparent. NAUMANN always associates these two phenomena. He goes even further back, in his Figures 4^1 to 4^5 Plate IV, to show the origin of the swellings and slits and the epidermis or "Haut". The figures are entirely unconvincing and misinterpreted by him. Thus, for instance, his Figures 4^1 and 4^5 Plate IV, are not beginning stages of the formation of swellings and slits but they are cross sections of several fairly well developed leaflets which have grown obliquely upwards and which lie closely pressed together.

As we have already pointed out the nature of the epidermis or "Haut" is the critical point in testing out GOEBEL's theory of the origin of the leaflets since he believes it to be a secondary development, arising after folding of the lamina has taken place. NAUMANN recognizes that this is the crucial point. He attempts to show the presence and development of this epidermis before folding has occured and that it is a part of the leaf and not an accessory structure as GOEBEL maintains. His observation are only in part correct since we have seen that the epidermis or "Haut" existed before there was any indication of leaflet development.

The attempt of NAUMANN to trace back the origin of the swellings and the slits to definitely localized regions within the growing leaf, although erroneously figured, was an attempt that would have yielded more fruitful results had the right technique been available.

To VON MOHL and to NAUMANN must be given their due credit in the interpretation of the phenomena of leaflet and segment origin in the palms. Both of these authors did not go back far enough in the young stages to see what is actually going on within the deliminated lamina.

The steps in the formation of the leaf in the oil palm (*Elaeis guineensis* JACQ.) used as a basis for contrast with what has been described in other palms, calls for a reinvestigation of the origin of the leaf in the Palmae.

It does not seem probable that *Elaeis* forms a rare exception. It is too closely related to the Cocos palms to stand as an isolated case. We may briefly summarize the stages in development of the oil palm leaf:

Summary.

1). The young leaf arises as a hook or blunt protuberance from the growing region.
2). Growth in height and width as well as in a circle goes on rapidly.
3). The lamina is deliminated from the petiole and base by:
(a) an horizontal furrow in the juvenile leaf (lanceolate leaf).
(b) a vertical furrow in the pinnate leaf.
4). Leaflets and segments owe their origin to individual 'Anlagen' within the young leaf blade.
5). These 'Anlagen' maintain their individuality.
6). Development of the leaflets goes on within the lamina, before there is any outward indication of their presence.
7). Only definite parts of the lamina contribute to the formation of these leaflets — the rest form the envelope ('Haut') surrounding these leaflets.
8). Splitting of the leaflets occurs when they are within the enveloping tissue.
9). Formation of an epidermis in the leaflets follows immediately upon splitting.
10). Growth of the leaflets against the envelope gives an outward appearance of swellings ("Wülste" of NAUMANN).
11). Further pressure causes the tissue to rupture between developing leaflets (slits of VON MOHL and NAUMANN).
12). Leaflets shift their plane of growth.
13). Leaflets are for a time sac-like structures, then through growth and mutual pressure they become elongated and flattened.
14) The strip at the edge — the remains of the original lamina, persists and it is stretched to give an awn-like appearance to the tip of the leaflet.
15). Juvenile unsegmented leaves arise like fully segmented leaves. The plane of the 'Anlagen' is horizontal like in fan palms.
16). Transition from juvenile to mature leaf is accompanied by shifting of the horizontal plane to the vertical.
17). The number of leaflets in the mature palm is many times that of the young palm.
18). About 60 leaves in various stages of development are found in a five year old tree. On the basis of observations of the number of leaves unfolded by an oil palm per year, it takes from $2^1/_2$ to 3 years for a leaf to fully develop.
19). The leaf sheath is a conspicuous and persistent organ originating soon after the leaf is deliminated.

The Root.

General.

The root of the oil palm (*Elais guineensis* JACQ.) like the roots of all palms is an organ which carries on the physiological functions of such organs and it also serves as a means of anchorage. So effective, is this anchorage that the tree exposed to the severest strain, cannot be uprooted. The oil palm in common with the coconut palm cannot be uprooted even by the severest storms. BÜCHER and FICKENDEY ([3]) state that they do not know of a single case of uprooting in Misahöhe (Togo). It is not surprising that such is the case in view of the texture, the disposition, the number and length of the roots. The roots are tough and elastic and they persist long after the cells have died. The roots are attached to the base of the trunk: they radiate in all directions, ramifying the soil for a considerable distance. BÜCHER and FICKENDEY (l. c.) observed roots 15 M. long and BÜCHER traced roots to a depth of 9 M. From the base of the trunk thousands of roots emerge. New ones constantly added, the older ones persist so that the anchorage is continually being strengthened.

The roots do not vary so very greatly in diameter, 4 to 10 mm. The secondary roots arising from them are naturally smaller and together they form a dense network. In moist localities the tendency to produce adventitious roots is most pronounced. These roots are positively geotropic and eventually they grow into the soil. These adventitious roots may in some-cases emerge at a considerable distance from the ground. BÜCHER and FICKENDEY (l. c.) show a tree with roots 1 Meter above the ground. Whereas COPELAND ([5]) estimates the number of roots attached to the buried part of the stem of a mature coco-nut tree as 8000, the number in a mature oil palm, excluding the adventitious roots, easily equals that number.

The structure of the root of oil palm does not show any marked departures from the structures of other palm roots which have been investigated in such great detail by the older investigators. The work of VON MOHL who contributed the anatomical studies to MARTIUS' ([21]) monumental work on the palms is indeed a classic in precision and in observation. One of the conspicuous features in the roots of Elaeis when cut in cross section, is the presence of the radiating lacunae or air chambers. These VON MOHL (l.c.) had observed and pictured for the root of *Diplothimium maritimum.* (Plate I, Figure 6).

In the same year 1850 there appeared a posthumous work of GRIFFITH ([11]) on the palms of British East India and there too such a root is pictured for *Phoenix sylvestris* (Plate CCXXVIII, Figures 4 and 5). GRIFFITH described the section of the root shown in Figure 4 as follows: "Section of a radicle, shewing the existence of large cells between the centre and the cuticle, and the origin of a young radicle from the central part". In Figure 5

he shows the same air spaces in the neck piece which joins the young seedling with the haustorium. In plate CCXXXA he has a figure which although it is not labelled as such, is undoubtedly a cross section of a root with lacunae; the form is *Areca triandra*.

GOEBEL in (1886) called attention to the breathing organs of the marsh plants *Sonneratia* and *Avicennia*. These plants develop side roots which are negatively geotropic and whose anatomical structure shows that they function as organs of gas exchange.

JOST ([15]) one year later published his observations on breathing organs in plants based primarily on work with palms. For those organs he coined the word pneumathode. These pneumathodes grow upward, outgrowths from larger roots. He found such organs in the following plants:

Livistona australis, L. chinensis, L. altissima, L. mauritiformis, P. olivaeformis, Phoenix reclinata, P. silvestris, P. dactylifera, P. spinosa, P. farinifera and other undetermined species.

Pritchardia filamentosa
Kentia Forsteriana
Chamaerops humulis
Chamaedorea Veitchii
Cocos flexuosa
Caryota furfuracea
Thrinax species
Pandanus flexuosus, P. pygmaeus, P. furcatus.

JOST observed in *Livistona australis* which was growing in a large wooden tub, a large number of upright growing structures 2 — 4 mm. thick and 5 mm. above the surface of the soil. A characteristic mealy appearing tissue either in the form of rings or covering the whole surface of the protruding organs is described. These structures are side branches which arise endogenously from the larger roots. In their anatomical structure, lack of epidermis and presence of a characteristic aerenchymous tissue, the presence of large inter-cellular spaces in direct connection with the root, and the fact that the root comes in contact with the air only through the pneumathodes speaks for their function. Experiment showed that these pnematodes were produced underground also. JOST showed these organs to contain a large amount of air. The cells of the mealy appearing tissue in cross section are stellate in form.

JOST observed similar pneumathodes in *Saccharum*, *Cyperus textilis* and *Luffa amara* Roxbhg. SCHENK ([33]) describes the presence of dimorphic roots in the mangrove plants *Avicennia tomentosa* and *Laguncularia racemosa*. The structure of these and other mangrove plants is too well known to bear repetition here. However, mention must be made of the origin of the air passages through schizogamy and lysiginy For a detailed consideration of the aerenchyma of marsh plants, wich we shall not consider here but in a later publication, reference should be made to another publication of SCHENCK's ([34]).

Air chambers-origin.

The root of the oil palm in general conforms te the description of monocotyledenous roots and no attempt will be made here to enter into any great detail about the familiar parts of this organ. There are however conspicuous features which merit close examination. The presence of lacunae or air chambers, structures which we have noted for several forms, are found in all roots of *Elaeis* as a normal condition directly correlated with definite physiological functions. These lacunae (Figure 53, Plate VII, Figures 119 and 120 Plate XV and Figures 113 to 115 Plate XIV) are present in the very youngest and oldest of plants irrespective of locality.

The origin of these lacunae is not difficult to trace. By making cross sections at various levels from the tip upwards complete stages can be secured. A section through the embryonic regions of the plerome and the periblem shows that the cells are irregularly disposed and in an active state of division. A section a little above the embryonic regions shows the cells in a definite arrangement. Figure 54, Plate VII is a cross section of such a region. The large epidermal cells are conspicuous in contrast to the other cells. Contrary to the statement made by BÜCHER and FICKENDEY ([3]), I was unable to find any root hairs in *Elaeis* developed from the epidermis. In Figures 116 and 117 Plate XV two views of the epidermal layer are seen in cross and longitudinal sections respectively. The cells directly inward from the epidermis with strongly thickened walls and which are suberized mark the outer boundary of the hypodermis that is being developed. The layer of cells following those have not yet been suberized. Then follow polygonal parenchyma cells and scattered among the parenchyma cells are still larger polygonal cells which contain bundles of raphides, presumably calcium oxalate. Bast cells (Figure 118 Plate XV) have already begun to appear forming a somewhat irregular zone in this stage. The conspicuous rows of radiating cells (Figure 54 Plate VII) beginning a little distance from the endodermis will ultimately be the seat of origin of the lacunae or air chambers. The mutual pressure exerted by the thin walled cells results in polygonal outlines. The inner boundaries of these radiating groups of cells are marked by a zone of cells, seven or more layers in thickness, whose long axes run at right angles to the radius of the section. This zone of parenchyma extends to the endodermis (Figures 53 and 54 Plate VII and Figures 114, 115 Plate XIV). Within the endodermis are the xylem, phloem, parenchyma and pith cells.

The gross details of the root of *Elaesis guineensis* indicating the lacunae have been published by DE WILDEMAN ([11]) taken from the notes of DE BRIEY.

As one proceeds further upward from the growing point differentation within the root goes on very rapidly. That part of the root becomes more rigid as result of changes in tissue and cell structure. More layers of suberized cells are added to the hypodermis, the bast cells increase in number

and the parenchyma surrounding the previously scattered bast is gradually being occupied by bast cells. The parenchyma cells arranged in radiating groups are not modified but are subjected to a centrifugal force which results in separation of groups of cells giving rise to cavities running up and down the length of the root which in cross section are seen in the form of radiating lacunae (Figure 53 Plate VII and Figures 113—115 Plate XIV). The cavities in the early stages of formation appear in cross sections as isolated splits or slits. Figure 113 Plate XIV shows a sector of such a cross section with the fissures more or less arbitrarily disposed. Radii projected from the center of the section would pass through one or more such fissures. Where there is more than one fissure through which the radius passes, these will ultimately coalesce to form a single air chamber. The partitions or septa separating the chambers vary in thickness. They may be one, two, three, four or more cells thick. (Figures 114, 115 Plate XIV). As a rule the cross-sectional length of the chamber is determined by the zone of bast just inside of the hypodermis on the one end and by the zone of parenchyma cells whose long axes run parallel with the circumference — a zone to which we have already referred. Occasionally the lacunae are seen in cross section apparently as cavities that have not separated entirely along the line of cleavage. While that may be true it must be remembered also that the course of the lacunae up and down does not run in a true straight vertical plane — that they do not necessarily run the full length of the root but they may begin and end at any level, so that in a cross section one may cut through the tapering ends of such lacunae, (Figure 114 Plate XIV). The air spaces ramify throughout the root affording a most efficient aerating system.

With the release of mutual pressure from the polygonal thin walled parenchymous cells resulting from the separation along the lines already indicated, the cells of the septa loose their polygonal form and become rounded as is shown in Figures 114 and 115; also inter-cellular spaces appear between adjacent cells. The inter cellular spaces afford easy communication between air chambers.

FREIDENFELT to whose original work I unfortunately had no access during this study is quoted by BÜSGEN ([3a]) as stating that the formation of lacunae between layers of tissue is a characteristic of hydrophyllous roots — also that the development of a strong hypodermis is found in such roots. The root of *Elaeis* answers both conditions and its natural habitat, the tropical forest of Africa and South America, places it in the category of plants with hydrophyllous roots.

The evidence taken from the free hand sections of living material and from prepared and stained slides tends to support the schizogamous origin of the air chambers in *Elaeis*. The presence of torn and shrunken cells bounding the cavities is strong evidence for such an interpretation (Figure 114). Such cells have been observed in the very early stages of lacunae formation

as well as in the fully formed air chambers. It appears that the orientation of the radiating tissue in the direction that is shown in Figure 54, Plate VII allows for just such a mechanical process to take place namely tearing along lines of least resistance.

DE HAAN ([13]) has also figured such cavities for the rice plant grown in Java again confirming FREIDENFELTS (l.c.) contention. The septa however are much thinner, tearing resulting in establishing freer communication between lacunae and consequently fewer lacunae. The cells shown by DE HAAN give evidence of tearing.

The very youngest of roots in seedlings with only one leaf unfolded, develop these lacunae and no single root of the countless that have been examined from a very large number of plants in all stages of growth showed other than the structure described above. It must be assumed then that in *Elaeis* that is the normal condition associated with definite physiological functions. These lacunae are present in roots that have produced no pneumathodes.

Secondary roots.

Two kinds of secondary roots are produced from the larger roots — the ordinary nutritive root and the modified root structure, the pneumathode. Both arise endogenously so that their initial stages are the same. The former develops in the manner indicated for the other roots — the latter undergoes modifications which enables it to perform its special functions. To this modified root we shall return for a more detailed consideration.

The further one goes from the growing point of the root the more complete the differention within the root has progressed. The hypodermis has become a rigid structure, the cells of the epidermis have begun to degenerate and they ultimately slough off, the schlerenchyma tissue has increased. The only thin walled cells remaining unmodified are those of the septa of the lacunae and small areas of the phloem. The root has taken on a distinctly woody character, tough and resistant. The steps in such changes shall not be discussed further in view of the voluminous literature on the subject.

Adventitious roots.

The adventitious roots which develop in some cases for some distance above the ground and those that emerge just a short distance above the level of the soil and then proceed to grow into the soil are as a rule of a larger diameter and they do not branch as freely as the subterranean roots. They are brownish red in color with very conspicuous root caps. Occasionally these roots show zones indicating the various places of attachment

of the root cap, suggesting perhaps periods of accelerated growth alternating with periods of protracted growth (Figures 123 and 126 Plate XV). Figures 122, 124 and 125 Plate XV show the branched character of these aerial roots. In Figure 121 an unusually large root cap is seen.

Secondary roots from these adventitious roots develop in the usual way — occasionally they begin to develop when the hypodermis of the mother-root is too resistant and cannot be pierced and so they are forced to grow down the length of the root within the space enclosed by the hypodermis, emerging at a point where the resistance of the hypodermis can be overcome. Such a condition is shown in Figure 124.

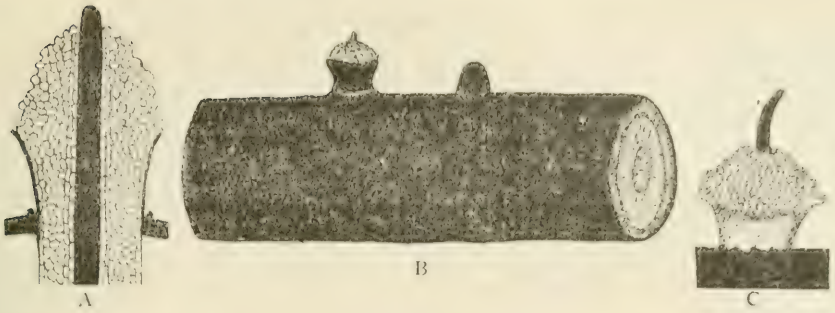
Figure 115 Plate XIV is a sector of a cross-section of an adventitious root in which differention has advanced to almost a complete stage. The epidermal cells however are still intact even though the hypodermis is quite fully developed. The changes that have taken place can be best seen by contrasting figures 114 and 115. The parenchymous cells of the septa or lamellae have remained unmodified throughout although an occasional schlerenchymous cell develops here and there (Figure 115). When the root dies only the cells of the septa degenerate so that it is quite characteristic for such roots in a dead condition to separate into distinct elements, a tubular shell composed of hypodermis and bast and within that shell the rest of the root tissure which includes everything within the endodermis and the zone of cells which have gone over into a schlerenchymous ring shown in Figure 115.

The absence of root hairs and the early development of an hypodermis limits the absorptive area to the region of the growing point. The condition in the oil palm root agrees with the observations of COPELAND (5) on the coco-nut palm. Water absorption is maintained through the epidermis near the tip. In *Cocos* this region according to COPELAND extends 5 cm. from the tip, the region beyond is occupied by the hypodermis. In drought this hypodermis grows quite close to the tip (2 cm.).

The pneumathodes.

The second group of secondary roots consists of the pneumathodes which are distributed every where on the roots both on the nutritive and adventitious roots.

The structures occur normally upon the roots of the oil palm and there can be no doubt that they are associated with aeration. The pneumathodes appearing on the adventitious roots are shorter and broader than those appearing on the underground roots. On the underground roots they are longer and narrower. Except for their somewhat smaller size the pneumathodes are like those found on the roots of the coco-nut palm. Many of the palms in the collections growing in the Gardens at Buitenzorg show simillar structures.



Text Figure 55.

A — longitudinal section through a mature pneumathode × 12;
B — portion of root with two pneumathodes — one just emerging the other mature × 5.
C — a mature pneumathode part of aerenchyma sloughed off showing central bundle × 10.

In text Figure 55 B two such pneumathodes are seen on a portion of a root. The one to the right is fully mature, the one to the left has just broken through and in its appearance looks like a secondary root. In their origin they do not differ from a secondary root an Figure 53 Plate VII may very well serve as an early atage of development of that organ. Such a root in cross-section shows in the center a single vascular bundle mostly occupied by thick-walled bast cells and with xylem cells towards the periphery. Surrounding the bundle is a layer of parenchyma cells — this is followed by a spongey parenchyma, then again a zone of parenchyma, and finally the epidermis. In the older structures the epidermis degenerates a strong hypodermis is developed and bast cells almost completely occupy the outermost zone of parenchyma.

When the pneumathode is mature, the epidermis and hypodermis at the tip, split and these are reflexed giving a vase shaped appearance to the structure. In text Figure 55C such a structure is seen. Here the central bundle stands out above the aerenchyma tissue as a result of the sloughing off of some of the tissue. In Figure 55A a longitudinal section shows the various layers. The hypodermis in the figure is represented by a thick line on either side where it energes from the larger root. As we have already stated, the cells of the aerenchyma are more or less stellate in form.

Such a spongey structure offers an excellent means for gas exchange and the presence of the air chambers in the larger root, allows for a very efficient system of aeration. The thick hypodermis and the woody character of the older root in general would allow practically no movement of gases from within, out and from without, in. With the pneumathodes in communication with the air chambers within the root the plant is adapted to withstand long submersion under water.

The finer details of the structure of the organ, its development and modifications have been reserved for another contribution. However, in the main the pneumathode (excepte for its outward appearance) agrees with the so called structure found in palms by JOST (l. c.).

Summary.

The oil palm ordinarily produces nutritive and adventitious roots.

Characteristic air chambers or lacunae are found in all the roots.

These chambers originate in the radially arranged parenchymous tissue of the periblem.

These chambers arise as fissures or slits in the tissue apparently through actual tearing of cells.

Two kinds of secondary roots are developed ordinary nutritive and pneumathodes.

There are no root hairs formed on any of the roots.

Pneumathodes are secondary roots with a single bundle running through the center and with specially developed aerenchymous tissue.

The fruit.

The gross anatomical structure of the oil palm fruit has served as the basis of classification of the many so-called varieties. Other characters of the tree have been employed in a lesser degree for that purpose. It is readily understood that a plant so extensively used by the indigenous populations, of Africa primarily, would receive native names based on obvious differences. The fruit of the plant being the part used by the natives, variations in the fruit then, have naturally been used for varietal classification. In the fruit the following distinguishing characters have been used: Color of fruit before and after ripening including presence or absence of anthocyan and chlorophyll.

Form of fruit

Thickness of shell — thick or thin shell

Absence of shell

Presence of accessory sterile carpels.

Varieties of fruits.

As a result of these observations a very large synonomy has sprung up — the natives of a given locality naming the forms found growing there. The work of the investigators who have attempted to systematize the forms has unfortunately led to no satisfactory classification, at least not from the point of view of the student of genetics. That these differences exist cannot be denied. However no work has been done to ascertain to what extemt such differences may be due to variations within a given line, how stable those differences are, what rôle environment plays, and what can be ascribed to teratological and to pathological phenomena. My investigations in that direction ([13]) which have served as the basis of a small contribution and for the basis of a more extensive one to appear later have led me to question the diagnostic value of many such characters.

If for the present we ignore characters other than pericarp, shell and kernel we find that those three elements of the fruit are highly variable. The constancy of these characters in inheritance is up to the present unknown. The few isolated observations that have been reported are more suggestive than convincing. They do at least indicate that of the large number of varieties three tend to maintain a limited constancy. These are now being tested out. The classification of BECCARI ([2]) based entirely on the characters of the fruits, unsubstantiated by genetical investigations, is at best a highly artifical one. This criticism applies to the works of those who have published before him and many of those who have published since.

These preliminary remarks have been made to justify a closer examination of those forms in *Elaeis* which appear to show genetic constancy. In another publication ([13]) I have recognized three types of fruit as showing tendencies towards stability (thick, medium and thin-shelled) and two others the so-called pisifera with no shell and the diwakkawaka with six accessory carpels, forms that although distinct, may very well be pathological and teratological forms.

Differences in fruits.

The differences in the three forms are differences in the proportions of the three elements, namely pericarp (epi and mesocarp) shell (endocarp), and kernel. In Figures 58 and 59 Plate VIII, the cross and longitudinal sections of a thick-shelled form are seen. The shell occupies, in proportion to the rest of the fruit, the largest volume. The pericarp which yields the commercial product is very much reduced as well as the kernel which yields kernel oil. The variations that exist in the size of the kernel find a parallel in the variations in the size of the fruits within a bunch. The fruits at the end of the branches, that is the outside fruits, are, because of their position, larger than the inner fruits. In bunches where only few fruits have been set these grow unusually large giving rise to fruits perhaps one and one half times the size of normal fruits. Such fruits have been given varietal names by BECCARI ([2]) and ANNET ([1]), the socalled *macrocarya* variety.

In the longitudinal section of the thick shelled form bast fibres run from the base of the fruit through the pericarp, around the shell ending at various levels, some running through to the tip of the fruit. In early stages of development, before the shell is formed, the bast fibres are found traversing the whole length of the growing fruit and when the shell is ultimately laid down many of the fibres in the region occupied by the shell are included in the shell structure so that there is a direct communication between the shell, the pericarp, and the fruit bunch.

The triangular cavity in the center of the cross section of Figure 58 and the longitudinal furrow in Figure 59 indicate the cavity within the kernel. This cavity is homologous with the large water containing cavity of the

coco-nut fruit. The haustorium of the embryo is in direct communication with it. From the base of the fruit a number of fibres appear to end abruptly when they reach the shell. In reality they pass through into the shell and some of those pass out of the shell into the tip of the fruit. Other fibres running tangentially to the shell are bent so that they conform to the outline of the shell. This can readily be seen when the pulp of the fruit is removed and the fibres are seen surrounding the stone. In a cross section of a fruit one can readily recognize two kinds of fibres, the brown or black ones immediately surrounding the shell, and the light colored ones scattered throughout the pulp.

In Figures 60 and 61 Plate VIII, the cross and longitudinal sections of the fruit with the medium thick shell are seen. The reduction in the thickness of the shell and the increase in the size of the pericarp make this form a more desirable type from the point of view of oil production. That is readily seen in contrasting this form with the one previously described. In Figure 60 a ring of isolated fibres of the same color as the shell indicate the fibres which were tangential to the shell and during the growth of the shell were bent conforming to the curvature of the shell.

The form with the thin shell (Figures 62 and 63) shows a striking difference in the thickness of shell when contrasted with the other two. This comparatively thin shell offers very little resistance to cracking and is esteemed highly by the natives of Africa for that property since the kernel can be secured with so little effort. Except for the thin shell the structure of this form is like that of the other two.

Variations within a form.

The variations that exist within a given form can in a measure be seen from the cross sections of several fruits from the thin shelled form taken from different trees. These form a very interesting series. For the present we may assume that the shell represents a definite volume composed of bast fibres set in a matrix of stone cells, like so many straws in a brick. These brown or black fibres can be seen in varying proportions in the cross sections In the medium thick shell Figure 60 we have seen them as ring of isolated fibres close to the shell. In Figure 64, in the thin shelled form, they also form a single ring around the shell. In Figure 65 these fibres are also in a ring but the individual fibres are coarser. In Figure 62 the fibres form a wider zone around the shell — they show varying cross-sectional areas. The fruit in Figure 67 shows a wider distribution of the fibres; they occupy a comparatively thick zone around the shell. In Figure 66 these fibres are scattered throughout the pulp almost to the outermost periphery.

If we now draw an imaginary circle around each zone of brown to black fibres we find naturally, if we include the dark fibres in the elements of the shell, that the cross sectional area of the shell elements has been widened so that a form shown in Figure 67 approaches very closely a medium thick shell and a form like the one shown in Figure 66

aproaches the thick shelled form. It is quite evident that a fruit of the character of the one shown in Figure 66 will yield less pericarp than any of the others excluding the thick shelled form. This is of importance to the selectionist who is seeking to establish a form with a minimum amount of waste product — the shell and its elements are designated as such by the commercial exploiter of the oil palm.

Pisifera or shell-less form of fruit.

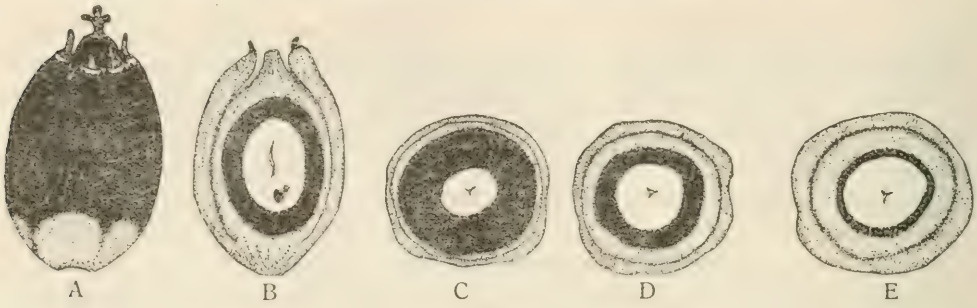
The so called shell-less form is the other extreme of a series the other end being occupied by the thick shelled form. In Figures 68 and 69 the cross and longitudinal sections of this form are seen. In this form, it has already been stated, the shell is entirely missing. In the cross section the eccentric circle represents the endosperm. The bounding line is not a reduced shell but a layer of cork cells surrounding the endosperm in all forms and which is readily separated from the shell in the forms with a shell. A section of such a cork layer is shown in Figure 146 Plate XVII. The crescent like structure in immediate contact with cork layer is the operculum, which organ plays an important rôle during germination. In the cross section the extent of the dark fibres is shown deliminating the area normally occupied by the shell. In the longitudinal section these fibres are seen traversing the length of the fruit.

In many of the fruits in a bunch the embryo is normally developed and an endosperm is present; in other fruits from the bunch there is neither embryo nor endosperm — there are however dark fibres present. All the indications point to a pathological condition. That has been already suggested by BECCARI (l.c.).

All the variations that exist in shell thickness, shell size, pericarp thickness, kernel size have not been included here. One can readily arrange from specimens taken from the trees that occur in a plantation a progressive series of parts of fruits showing reduction or increase in size of individual parts of the fruits. From the types of shell that have been discussed such a series can be made from the forms shown in Plate VIII. However, it is not maintained that they indicate an evolutionary series.

Fruit with accessory floral parts.

A type of fruit that has been recently given a specific rank by ANNET (1) *Elaeis Poissoni*, the Klude form described by GRUNER (12) from Togo, the diwakkawaka of BÜCHER and FICKENDEY (3), is characterized by the presence of, as a rule, six accessory sterile carpels surrounding the normal fruit. These accessory carpels contain oil like the pericarp of the fruit and for that reason this form is considered valuable if it can maintain its character. This form is found also with thick, medium and thin shell. (Text figures 56 A, B, C, D, and E.) Examples of the forms are grown in Java.



Text Figure 56.

A — diwakkawaka fruit natural size, B — longitudinal section of thick-shelled form. C — a cross section thick-shelled form. D — cross section of a medium-shelled form. E — cross section of a thin-shelled form.

The phenomena of accessory floral parts or modified floral parts are too well known to need discussion here. The palm fruit with the accessory sterile carpels is merely a case of what is commonly called doubling and certainly such a case of floral modification deserves no specific rank. If such characters are diagnostic characters for species then all the teratological forms listed, and these are legion, must also be raised to specific rank.

Text Figures 56, A, B, C, D, and E show the external appearance of such a fruit, a longitudinal and cross section of a thick-shelled form, a cross section of a medium thick-shelled form, and a cross section of a thin-shelled form respectively. The longitudinal sections of the last two forms are, with the exeption of the shell-thickness, like the longitudinal section shown in Figure B.

Distribution of the fibres.

The distribution of the dark colored fibres can be readily studied in the shell-less fruit — the *pisfera* form. By cutting sections at various levels beginning at the base and at intervals until the tip is reached, they can be traced. (Figure 70, Plate VIII) is a section near the base of the fruit. The dark fibres are grouped together in the center of the section, the lighter colored ones are distributed irregularly through the pericarp. A little higher up these dark fibres begin to separate and they are seen in the following section, Figure 71, in the form of a circle surrounding the outlines of the three carpels, which are represented here as three circles within the larger one. In Figure 72, a still higher section, this is brought out more distinctly. Here the dark fibres are seen in the form of a circle and as three radii dividing the circle into equal sectors. In the following section (Figure 73) the three opercula, in the form of crescent like structures appear, only one however, as we shall see later, develops completely. The next two figures (Figures 74 and 75) show sections through the single endosperm, the embryo within the endosperm and its relation to the operculum. In these last

two sections the fibres of the radii present in a lower section have disappeared and the endosperm lies surrounded by fat cells.

Seedless fruits.

Another type of fruit must be mentioned here the so-called parthenocarpic fruit, which in some instances reaches the size of normal fruit; its pericarp is rich in oil. It differs from the normal fruit in the absence of endosperm and embryo and in the presence of a reduced pit solid through out. In this pit, stone and bast cells occupy the space normally occupied by endosperm and embryo. Whether this fruit is truly parthenocarpic or whether it is a result of fertilization followed by abortion allowing the developing shell to push into the cavity has not been determined. In cutting through such solid pits one finds traces of the three opercula.

Shell structure.

A comparison of the shell of the three types the thick, the medium and the thin shell shows, as one would expect, that it is merely a difference in the number of fibres and the cementing cells, the stone cells. This is brought out in Figures 76, 77 and 78 Plate VIII. These are portions of cross sections of the shell secured by grinding them down to the appropriate thickness for microscopic observation. For more detailed observations maceration was necessary. The size of individual fibres vary — the very largest as a rule are found on the periphery of the shell partially imbedded in the stone cells. That is seen from the figures. The fibres are held in place by a more less suberized layer of cells immediately surrounding the shell. This layer is strongly developed in the thin-shelled form the dotted area in Figure 76 represents that area. On both inner and outer surfaces of the shell cork layers of varying thickness are found.

The shell in nature is dark brown or black and the fibres can be seen in cross section as lighter brown dots within the shell. Figure 79 shows a cross section of one of the larger fibres in the shell surrounded by some of the stone cells. This bundle shows three distinct regions, an outer zone of cells with thickened walls, the so-called stegmata of WIESNER ([40]) which in *Attalea* contain crystals of silica, an inner thick zone of thickened bast cells and a central region the conducting tissue. This bundle corresponds to the bundle found in the neck piece of the haustorium shown in Figure 133 Plate XVI. Apparently these cells have ceased to function judged from their appearance in fully mature shells. In shells which have not yet been hardened and which can readily be cut through with a razor blade, the bundles show the same structure. The bast in such fibres, however, is not so strongly developed.

Details of the pisifera fruit.

The absence of shell in the *pisifera* type and the presence of a normal embryo and a reduced endosperm offers an opportunity for observation secured

only with the greatest difficulty in a form with a shell. The relationship of parts is clearly demonstrated in (Figure 80 Plate IX). This is a section through a fully mature *pisifera* fruit. This section passed through the embryo, the endosperm, the three opercula and the surrounding tissue. The regions here are definitely deliminated from each other in spite of the absence of a shell. These are the pericarp, the region which normally is occupied by a shell, and the endosperm with the cavity of the embryo. Between the pericarp and the cork zone of the endosperm there is a zone almost completely surrounding the endosperm, which in Figure 80 is seen as a dotted area in which bast fibres are seen in longitudinal and cross sections. This zone is presumably homologous with the shell in the other forms.

In the forms where there is only a single embryo developed only one operculum develops completely, the other two are as a rule enveloped by the developing shell and they can be recognized as such even in the fully mature shell by cutting through the shell in the region where they lie. In the *pisifera* form the zone homologous with the shell does not pass around and enclose the other two opercula.

It is interesting to compare these opercula, the one that is to function and the other two that are aborted. All three have in common a two layered structure, each layer of single cells. The cells facing the embryo and the endosperm are stone cells, more or less isodiametrical in form. These stone cells are not shown in the operculum capping the endosperm. They are however shown in the other two opercula. The other layer of palisade cells is also composed of sclerenchyma cells; these cells are rod-shaped. The line of demarcation between the two layers is readily seen. In the operculum that is to function, the horns of the crescent have grown around and reach for some distance around the kernel. The horns of this crescent are in turn partially enclosed by the tissue which is homologous with the shell. The operculum in cross section presents the characteristic crescent form. In the aborted opercula the ends are blunter and instead of growing down and around they are reflexed giving them also a characteristic appearance.

Attached to the convex surface of the operculum are many fibres branched and unbranched. These fibres establish a direct communication between the operculum and the tissue of the pericarp. These fibres, like the fibres seen in cross section scattered though the pericarp, have the same structure as the fibres that we have described in and outside of the shell. The fibres are attached to the operculum by means of a thin cork layer. It is evident then that whatever communication takes place between the operculum and the surrounding tissue is accomplished through these fibres. In the forms with a shell these fibres pass through the germ pore into the pericarp tissue.

The zone immediately surrouding the endosperm is made up of compressed spindle shaped nucleated cells — colorless. They do not contain oil-

The cells pass over gradually into the dark brown cork cells with no cell contents which are directly in contact with the endosperm. The thin layer between the concave surface of the operculum and the endosperm in the vicinity of the embryo is composed of the same kind of cells. A very thin zone of spindle cells surrounds the aborted opercula.

The endosperm tissue does not differ from the endosperm tissue in the shelled forms which we shall discuss later.

The pericarp tissue in a state prior to ripening of the fruit is made up of polygonal cells. When the process of ripening is complete these cells become rounded. At low magnifications the orange colored fat globules indicate the distribution of the cells of the pericarp (Figure 80). The process of ripening has been recently described by TOBLER ([35]) although no figures are given to show the condition of the cells prior to and during the process of ripening.

It is not unusual to find two and three embryos in a seed and in rare cases also four (Figures 99—104 Plate XI). In each case there is no communication between the embryos, they are separated from each other by stone partitions. In the *pisifera* form two embryos are common and several with three have been seen.

The various steps in the development of the oil palm fruit prior to and after fertilization are being investigated by my former colleague Dr. CARL HEUSSER of the Algemeene Proefstation der A.V.R.O.S. Medan Sumatra.

For a discussion of the literature on the anatomy of the palm fruit WIESNER's ([40]) "Die Rohstoffe des Pflanzenreiches" is invaluable. Attention must be called to the similarity of the structure of the bundles (fibres) in the shell of *Elaeis* and *Attalea* (WIESNER l. c. Bd. III p. 810 Figure 285.

Summary.

1). Varietal distinctions are based on fruit characters.
2). Our fragmentary genetic evidence points to three types of fruit which may be constant — thick, medium, and thin-shelled.
3). Differences in fruits are differences in the proportions of pericarp, shell and kernel.
4). Within a given form great variation exists.
5). In the shell-less form, a shell is entirely lacking although the region of the shell is present in a modified state. It may very well be a pathological form.
6). Form with accessory floral parts may merely be a teratological form and cannot be considered of specific rank.
7). Fibres can readily be traced in the *pisifera* form.
8). The so-called parthenocarpic fruits contain oil in the pericarp like the normal fruit-pit is solid throughout.
9). Differences in shell thickness are differences in the proportions of bast and stone cell elements.

10). The pisifera fruit is a favorable object for study of the relationship of parts.

11). The operculum in the pisifera fruit in contact with the endosperm is fully developed in spite of the absence of a shell.

The endosperm.

Endosperm in the sense that it is used in this paper is the tissue of the seed that is absorbed by the haustorium for the growth of the young plant. The origin of this tissue has not been determined. This phase of the work is being pursued by my former colleague Dr. C. HEUSSER. The term endosperm is in general use for that structure in palm seeds.

The embryo in palms in general, is comparatively small, occupying but a small space in the seed. If we return to the plate showing the various fruits in cross and longitudinal section (Figures 58 to 69 Plate VIII), we find that the endosperm or kernel is a highly variable thing. The size of the endosperm is dependent upon the same environmental factors which influence the size of the fruit itself. These factors may be general nutrition of the whole plant, the number of female flowers produced per branch of an inflorescence, the number of fruit set, the number of embryos that develops within a given fruit etc. The largest kernel is found in the so-called *macrocarya* variety described by BECCARI (l.c.) and the smallest in the so-called *pisifera* variety. These two extremes are in my opinion reactions to definite environmental factors and are not to be considered as normal forms. Bunches that set only a few fruits very often show those abnormally large fruits. I have already stated before that the *pisifera* variety is very likely a pathological form.

When not mutually influenced by the pressure exerted upon each other as is the case when two or more endosperms are present within a seed, the endosperm tends to be more or less egg-shaped. When the kernel is removed from the shell it is very dark brown almost black in color. The whole surface of the kernel is covered with a very finely branched net of fibres. The kernel itself is quite hard and resistant after it has been exposed to the air for a time. In the fresh state after cutting through the cork layer surrounding the inner tissue the endosperm offers little resistance to the knife.

The layer surrounding the endosperm proper consists of three kinds of cells — an outer layer of two or more cells with thick walls and small lumina — then follows a thick layer of cells with black contents and light colored walls. These cells may be seen in their long or short axes (Figure 146 Plate XVII) and finally a third layer the inner one very much like the outer one. In describing this integument Hanausek (WIESNER l.c. p. 696 — 701) states that the inner of the three layers shows cells with granular contents.

The cells within the cork layer are the nutritive cells which are ultimately absorbed by the haustorium. In the freshly picked fruit the cells

of the endosperm are dull white in color. When the endosperm is cut in cross section it can be detected with the naked eye that the cells are arranged in rows radiating from the periphery towards the center of the kernel. This can be seen in Figures 130 and 131 Plate XVI and in Figure 144 plate XVII. In a tangential section (Figure 80, Plate IX) the cells are polygonal in outline, they de not show a radial arrangement. The walls of the cells are thick and the cells are in communication with their neighbors on all sides through pits in the wall (Figure 145, Plate XVII). The cells of the endosperm in their structure are like the cells of the date, *Phoenix dactylifera* described by SACHS ([31]) with this difference, namely the cell walls between the pits are not so strongly developed. The presence of the pits every where in the cell walls, allows for easy movement in all directions so that secretions from the haustorium can readily find their way to remote parts of the endosperm and movement of substances from the endosperm to the haustorium likewise is facilitated.

It has been previously stated that in the endosperm there are two cavities, one in which the embryo lies the form of which follows the outline of the embryo and the other in the center which in longitudinal section of the kernel is seen as a fissure running up and down or as a triangular opening in cross section. As a rule the two cavities are united by a tiny canal, running from the base of the cavity of the embryo into the larger one. This can be seen from Text Figure 57. Such an arrangement permits a very rapid passage of substances from the embryo to the endosperm. The cells of the endosperm do not end abruptly into these cavities. In the cavity in which the embryo lies the ends of the radiating cell rows are bent back so that they form a sort of felt zone lining the cavity. The cells of this felt zone are for the main empty and crushed together so that they can hardly be recognized as cells. The same holds true for the cell rows entering the larger cavity. They too form a felt zone lining the cavity. Occasionally where the cavity is rather large the frayed ends of the radiating rows of cells are not bent back against the sides of the cavity but they mat themselves half way into the cavity.

In the mature state the cavity is devoid of any fluid. There is nothing to correspond with the "milk" of the coco-nut. In fruits where the endosperm is just beginning to grow and fill up the cavity within the already well developed shell, that cavity is completely filled with a watery liquid. Contrary to the condition in the coco-nut fruit where germination can take place when the nut is hung up—the oil palm seed must have water before it can proceed to germinate. The intercommunication between cavities and the relation of the enbryo with the operculum also allows communication with the exterior of the seed. This can also be seen in Text Figure 57. The fibres emerging from the upper part of the operculum are in communication with the outside. There is no doubt that even when the fibres are dead, water passes through them towards the embryo.

Contents of endosperm.

In commerce the kernel yields kernel oil a product used in the industries. As high as fifty percent oil is secured from the endosperm, The oil is found in all the cells of the endosperm (except in the crushed cells that form the linings of the cavities) in the form of globules of varying sizes. The cells on the border between the periphery of the endosperm and the cork layer contain fewer drops of oil and also smaller aleuron grains. The other cells of the endosperm show varying proportions of oil and aleuron grains.

TSCHIRCH ([38]) gives the following as the composition of the kernel oil extracted from ELAEIS: main constituent lauric acid, oleicacid palmitic acid, myristic acid, caprylic acid, capric acid and phtytosterol. In prepared and fixed material the fat of the endosperm cells is crystalized out (WIESNER Bd. II. p. 699).

WIESNER ([49]) Bd. I p. 658 quoting from OUDMANS gives the following as the composition of kernel oil: oleic acid, glyceral tristearate, palmitic acid, myristic acid, lauric acid, capric acid, caprylic acid and caproic acid.

The aleuron grains too vary in size and they are found in all of the cells of the endosperm. These in their structure are like those described in other plant cells. The rhomboid and globoid crystals are included within a granular matrix.

In addition to the above mentioned contents of the cells must be included the nuclear and cytoplasmic remains of the cells which of course are absorbed by the haustorium. The endosperm furnishes to the growing plant the following substances.

1). Celluloses — from its cell walls.
2). Fats and oils stored in the cells.
3). Proteins and inorganic substances in the aleuron grains.
4). Cytoplasmic and nuclear substances and their inclusions.

Germination of the seed.*)

The immense amount of work that has been done on germination in in the monocotyledons alone makes it almost surperfluous to enter into a lengthy discussion of the literature here. That is equally true of the *Palmae* which have long been the objects of such investigations. *Elaeis* shows no marked departure in germination from other palms. There would be little justification for a detailed description of the stages were it not for the interesting internal phenomena that are associated with germination. All studies on germination in palms must go back to SACHS ([30, 31, 32]) work on germination in grasses and palms. To be sure VON MOHL and even earlier investigators have indicated the broad principles of germination in the palms. However, it was not until SACHS' work appeared that the intimate relationship of parts of the seed in the process of germination become known. The works that have followed since SACHS have extended

*) Klebs — Important survey of the types of germination and literature.

our knowledge of germination in palms as well as in other monocotyledons. TSCHIRCH [37] and his school have done much to further investigations along that line. Still, the number of detailed investigations on the relation between haustorium and endosperm are few. We have yet to await a thorough investigation of so conspicuous an organ as the haustorium of the coco-nut in its relation to the endosperm, although the cultural phase of that palm has been exploited intelligently for countless centuries. The fruit of the oil palm because of its size and because it offers no serious technical difficulties is a most favorable object for investigation.

If we turn now to the gross details of germination we can follow the steps in the process very readily. We have seen that the fruit of the oil palm can roughly be divided into pericarp, shell and kernel. When the fleshy, oil containing pericarp is removed the germ pores of the seed become visible. As a rule only one is functional since the rule is that one embryo develops in each seed. Attention has also been called to the presence of two, three and four embryos within a single seed. PFITZER [25] makes the following grouping of palm fruits based upon the presence or absence of definite regions for the emergence of the embryo during germination.

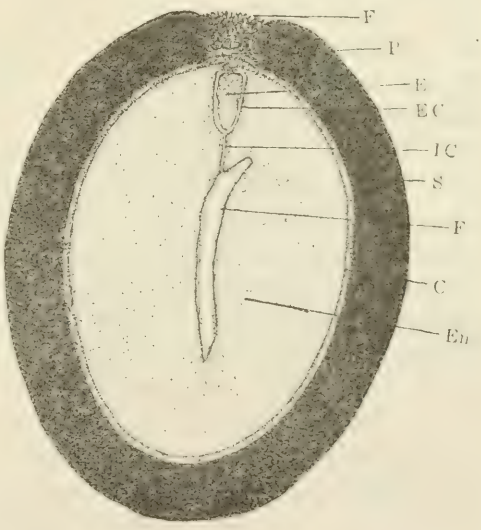
1). No definite locus in the shell — the embryo breaks-through the shell as a result of internal pressure exerted by the growing embryo.

2). Shell provided with definite areas less resistant than the rest of the shell — strands of soft tissue pass through those areas enabling the embryo to push its way through with but little resistance.

3). Presence of definite openings in the shell provided with plugs which are pushed out through the openings (germ pores) at germination.

The variations that exist in the last group have been indicated by PFITZER.

The fruit of the oil palm belongs to the third category. In the discussion of the fruit we have described the operculum. The pores run through the whole thickness of the shell so that the thickness of the shell apparently has no



Text Figure 57.
F — fibres radiating from the operculum, through the germ pore into the pericarp. P — operculum in cross section. E — embryo. E C — cavity in which embryo lies. I C intercommunicating canal. F — fissure in endosperm (homologous with large cavity in coco-nut) S — shell. E — endosperm. C — cork layer surrounding endosperm × 2 1/2.

significance for germination. Experiments undertaken by several investigators in Africa and in the Malay Archipelago show that the same fluctuations in germination exist among all types of fruits and even when the shell has been removed.

The embryo of *Elaeis* lies within a cavity in the endosperm completely surrounded by the endosperm tissue. (Text Figure 57). The cavity in which the embryo lies is in communication with the fissure in the endosperm which we have seen is present, and most likely is homologous with the conspicuous cavity in the fruit of *Cocos-nucifera*. The operculum can be readily removed in an intact state by breaking the shell. It is kept rigidly in place on the one side by the embryo and on the other side by the fibres and fleshy tissue of the pericarps which fill up the germ canal. The position of the operculum is seen in (Figures 82 and 83 Plate X). The operculum is a flattened cone with a diameter slightly less than the diameter of the canal. We have seen it in cross section in Figure 80 Plate IX. In Figures 96 and 97 Plate X we see its side and under surface views respectively. From its upper convex surfaces branched and umbranched fibres pass through the canal into the pericarp (Figure 80 Plate IX) establishing a communication between the external and internal environment of the embryo. These fibres like those in the *pisifera* fruit are made up of bast and conducting tissue. The fibres together with the cork layer which holds them in place give a roughened appearance to the outer surface of the operculum. The inner and concave surface is smooth (Figure 97) provided in the center with a tiny canal which ends blindly. Into this blind canal a nipple-like structure from the center of the flattened end of the embryo fits (Figure 82 and 84 Plate X). It is obvious that such an arrangement allows for a distribution of pressure from the growing embryo upon the operculum so that it is pushed straight out of the germ pore without rotation along the axis of its diameter.

In the fully ripe seed the embryo when exposed shows definite external differentiation. The haustorium is seen deliminated from the rest of the embryo; it is also lighter in color. Figure 82 Plate X represents an embryo taken from a ripe fruit. The constriction very near the middle is the boundary line between the haustorium and the remaining part of the embryo. In the haustorium itself longitudinal shallow furrows indicate the beginning of the pronounced ridges characteristic of the growing haustorium in later stages of germination. The portion of the embryo above the haustorium exept for the nipple-like growth on the flattened end, shows no outward differentiation.

With the beginning of germination the embryo begins to elongate at both ends, the haustorium eating its way into the endosperm and the rest begins to push through the canal towards the exterior. The nipple too elongates and becomes quite a conspicuous structure (Figure 84).

In the meantime the constriction at the upper end of the haustorium becomes more pronounced and in that region growth around the flanks goes on so that soon the diameter through the region is greater than the diameter of the pore, offering naturally, a barrier to the haustorium. This results as we shall see later in a flattened surface at the attached end of the haustorium. The presence also of a collar just beneath the shell prevents the haustorium from pushing out of the shell.

Growth of the embryo goes on simultaneously with growth of the haustorium and at the same time at the expense of the endosperm. After the embryo has pushed beyond the germ pore further external differentiation is apparent. The portion of the embryo between the attached end of the haustorium and the part containing the radicle etc., becomes the neck piece which connects the young plant with the haustorium. The radicle bursts through the sheath first, and occasionally the sheath has a regular saw-tooth edge. In Figure 95 the radicle has just forced its way through the sheath and the sheath has been torn in the regular manner described. After the emergence of the radicle the first leaf bursts through at the opposite end. In (Figures 81 to 88 Plate X) the various stages are shown in succession. In Figure 86 which is a longitudinal section through a seed showing the relationship of parts, the haustorium has made considerable growth. The stages that follow show the further unfolding of the embryo. The root system develops so that absorbtion of food from the haustorium is supplemented by food taken up by the roots and the food obtained by the photosynthetic processes of the green part of the plant. The haustorium continues to grow at the expense of the endosperm. In (Figures 92 and 94) half of the volume is now ocupied by the haustorium. In Figures 98 to 105 Plate XI where the root systems in the several seedlings have made a considerable growth perhaps about half of the endosperm has been used up. In a seedling with two fully unfolded leaves in active assimilation, the endosperm is just about used up (Figures 106 and 107, Plate XII).

The remains of the seed may be seen still atached to plants as old as two years. To be sure the haustorium has degenerated and commonly a root may find its way into the cavity and fill it up.

The presence of two, three and four embryos in a seed is always associated with an equivalent number of haustoria each embryo emerging from a germ pore. This can be seen from Figures 98 to 105 Plate XI. Figures 101, 102 and 103 show the haustoria in cross section.

The original sheath of the embryo persists for a long time and even in an advanced stage shown in Figure 106, Plate XII it is seen as brown leathery scales at the base of the stem.

The Haustorium.

The presence of an haustorium or an equivalent organ is widespread in the Monocotyledons. The haustorium is particularly characteristic of the palms and it has served as an object for investigation for over a century. Although the haustorium in its relation to germination has been known, it was not until SACHS' work appeared that the real significance of the whole process of germination in forms with an haustorium was understood. To be sure observations on the growth of the haustorium have been published and a publication appeared in 1811 by VOIGT entitled, "Analyse der Frucht und des Samenkorn von LOUIS CLAUDE RICHARDS".

On pages 174 and 175 RICHARDS ([39]) in describing the embryo of *Schoenus Mariscus* L. states the following:

"Unterwirft man diesen Embryo derselben Art von Analyse wie die vorigen, so erblickt man gleichfalls eine Gemmula, ein Cotyledon und eine Radicula. Die Keimung verändert aber die Form und die Richtung dieser drei Theile sehr sonderbar. Der Cotyledon schwillt im Endosperm an ohne jedoch dessen zu vergrössern, und wird länglich, ja gleichsam walzenformig". Figures E, F, G and H show unmistakably the germination stages where the haustorium (Cotyledon) enlarges at the expene of the endosperm.

In 1866, four years after SACHS' work appeared, the plates to accompany the observations of GAUDICHAUD ([9]) were published by D. ALLEIZETTE based on a voyage around the world by GAUDICHAUD in 1836 to 1837. In Plate 29 various germination stages in *Phytelephas Pavonii* are shown. In his Figure 3 he shows the haustorium eating its way into the endosperm. In the vicinity of the haustorium a dark somewhat irregular zone is pictured. No text description of that phase is given and it is very likely the zone of partially emptied cells in the vicinity of the haustorium. A section through the neck-piece shows a radial arrangement of bundles. In Figure 4 the haustorium removed from the endosperm is seen as irreguiar ovoid body. In Figure 5 a cross section of an haustorium is shown. However none of the drawings show any cellular structures. Two of the stages are reproduced in ENGLER and PRANTLES', „Die Natürlichen Pflanzenfamilien".

SACHS ([31]) in his work on the date palm quotes from VON MOHL who very cleary describes the growth of the haustorium at the expense of the endosperm. This is the only known case states SACHS, where a process similar to what he has seen in *Phoenix dactylifera* has been previously described. VON MOHL ([21]) made his observations on *Corypha frigida* and *Phoenix dactylifera* (Tab. P., Martius l.c.)

EBELING ([7]) investigated besides many forms of Monocotyledons, the following palms:

Phoenix dactylifera, *P. canariensis*, *Latania borbonica*, *P. tenuis*, *P. reclinata*, *Seaforthia elegans*, *Corypha Canna* and *Chamaerops elegans*

In all these forms he finds an agreement in the rôle of the haustorium. This organ grows at the expense of the endosperm.

The periphery of the haustorium is composed of thin-walled cells 2 to 4 times as long they are wide whose function it is to absorb the food substances from the endosperm. The layer underneath is composed of cells which are responsible for the continued growth of the haustorium. The haustorium is supplied with two thick bundles which are continued in the cotyledonary sheath. In contrast to the condition in the *Gramineae*, the haustorium of the palm absorbs the crushed cell walls of the endosperm.

TSCHIRCH ([37]) gives a long list of monocolyledenous plants that possess an haustorium. For our purpose however, it seems unnecessary to cite the many contributions that have been made on the subject of the haustorium in plants. The few citations that have been given will serve our purpose.

The form of the haustorium.

The form of the haustorium during its growth depends upon its position with reference to the endosperm. And the form of the entire endosperm will ultimately affect the form of the haustorium. In a fruit like the coconut the haustorium after it has passed out of the cavity in which the embryo lies, into the large cavity of the endosperm, meets no pressure and consequently develops equally in all directions so that it is usually ball shaped throughout its growth. Where the haustorium comes in contact with a more resistant element which it cannot readily digest it conforms more or less to the shape of the obstruction. In the date seed the haustorium ultimately comforms to the shape of the seed.

TSCHIRCH ([37]) recognizes three types of haustoria found in the Monocotyledons.

Gramineae type — in this form the haustorium (scutelum) lies to the side of the food storage tissue and it enlarges only slightly or not at all during germination.

Palm type — in this form the haustorium is surrounded by endosperm tissue and during germination grows into the endosperm growing and enlarging at its expense.

Zingiber type — in this form the haustorium although situated in the center of the food storage tissue, does not enlarge appreciably.

We have already called attention to the haustorium in the resting embryo. In that stage it is sharply deliminated from the rest of the embryo by a constriction. Furthermore in removing such embryos from the seed, a color difference is seen, the haustorium is white, the rest of the embryo is a very pale yellow with a faint tinge of green. In the resting state the haustorium is cone shaped in appearance with a blunt apex (Figure 82, Plate X). Parallel ridges run in the direction of its long axis. The ridges

themselves show tiny tubercular structures so that the outlines of the ridges under slight magnification are somewhat wavey.

With germination setting in changes in form of the haustorium begin to occur. The constriction begins to appear more pronounced, the ridges become more prominent and elongation takes place (Figure 84, Plate X). Returning to Text Figure 57, we see that the position of the embryo in the periphery of the endosperm and the fact that it is rigidly held in place by virtue of the cavity in which it lies and its subsequent emergence through the germ canal, allows for unequal fields of activity for various regions of the haustorium. The growth of the upper part of the haustorium is limited by the narrow zone of endosperm tissue surrounding it. As soon as all the endosperm tissue is used up no further growth is possible there, mainly, because of the physical barrier of the shell which is never dissolved away by the haustorium. Very soon then, the part of the haustorium attached to the neck piece comes in contact with the resistant shell and its form becomes the form of that part of the shell. In Figure 111, Plate XII, the flattened upper surface af an haustorium removed from the remaining endosperm and shell, is seen. This is from a late stage of development. Earlier stages of flattening of the upper end of the haustorium can be seen in Figures 86, 88, 92, and 94, Plate X. Where for some reason the activity of the upper part of the haustorium is not so pronouced as in other parts of the haustorium the form tends to become cylindrical (Figures 90 and 94). Ultimately however, the haustorium will become ball-shaped and in general will conform to the shape of the interior of the shell.

The presence of the ridges on the haustorium even in a resting condition, indicate that the subsequent growth of the haustorium is not limited to the mere surface of the sphere representing the haustorium. In a longitudinal section of an haustorium the embryo of which is just pushing its way beyond the germ pore the lobed end (Figure 128, Plate XVI), shows how a larger surface for digestion and absorption is obtained. A little later stage (Figure 129) shows the beginning of the formation of lobes on the sides of the haustorium. With the development of the haustorium there is a marked increase in the ridges in all directions so that whole haustorium has a convoluted appearance (Figures 102 to 105 Plate XI.).

In cross sections the relative distribution of the lobes in young and older haustoria can be seen. In younger haustoria the number of lobes are fewer. This can be seen by comparing Figure 130 with Figure 131, Plate XVI. In Figure 130 less than half of the endosperm has been digested, in Figure 131 about three fourths of the endosperm has been used up. The number of lobes increase with the growth of the haustorium.

Occasionally one finds kidney shaped haustoria or haustoria with a constriction running three fourths of the way in. Figure 109, Plate XII,

shows a side view of a kidney shaped haustorium and Figure 108 shows one with the above described constriction. A longitudinal view of such an haustorium is seen in Figure 127, Plate XVI. Local inhibition of growth which allows the rest of the tissue to grow beyond it can account for such structures.

Size of haustorium.

The ultimate size of the haustorium depends upon the volume of endosperm tissue that it has to displace since as we have seen all of the endosperm is absorbed. The great variation that exists in the size of the endosperm in the various types of fruits and within the fruits of one tree influences the ultimate size of the haustorium. The presence of two or more enbryos in a seed likewise influences the size of the individual haustoria. Thus we see that the haustoria in a fruit with two or three embryos (Figures 103 and 104, Plate XI) are half as large as those in fruits with one embryo (Figure 102), although all three types are in the same stage of development. The largest haustorium is found in the so-called *macrocarya* form and the smallest would occur in the *pisifera* form if germination of such a form were assured. A glance at the types of fruit shown in Plate VIII brings out the variations that may exist in the size of the haustorium of the oil palm.

The rôle of the cells of the haustorium and the endosperm during germination was for the first time described by SACHS ([30]), ([31]) and in order to orient ourselves on the many problems that are before us, a digest of his work on grasses and the date palm will be of material aid.

In the grasses the following salient features may be noted.

Between the endosperm and the shield (scutellum) a layer of crushed cells is present — these are the remains of endosperm cells.

Parenchyma cells of the shield show inter-cellular spaces.

No changes occur in the parenchyma cells during the whole process of germination; the shield is fully developed in the resting condition of the embryo.

Before germination no sugar is found in the endosperm and the starch grains are intact.

When the root in the wheat seedling is 1 cm. long and in corn 3 cm. long, the presence of sugar can be detected associated also with corrosion of starch grains.

The process begins where the endosperm is in contact with shield and then digestion moves slowly to remoter parts of the endosperm.

The parenchyma of the seedling becomes filled with starch grains.

Neither sugars nor starch are present in the epithelium (ferment layer) of the shield (scutellum) at any time during germination. The sugars that pass from the endosperm into the shield through the epithelium are either fixed by the nitrogenous substances in the cells or they are immediately

delivered to the cells of the parenchyma appearing there as starch. The epithelium also takes nitrogenous and protein substances from the endosperm.

In *Phoenix dactylifera* the following features may be noted:

Before germination no starch nor tannin is found in the embryo; proteins and fats are present.

The endosperm is composed of the well known thickened cells whose primary membrames can be seen as continuous double lamellae between the secondary wall thickenings; no inter-cellular spaces are present in the endosperm tissue.

The contents of the endosperm cells are proteins and droplets of oil-like substances; starch and tannin are not present in the cells.

The amount of oil in the endosperm is too small to account for the large amount of dextrose and starch in the parenchyma of the embryo at the beginning of germination and so the source of these is in the cell wall thickenings of the endosperm.

Bundles of the haustorium are the paths of transportation of proteins taken up by the haustorium to be delivered to the young plant.

With the beginning of germination oil disappears from the embryo proper and sugar is found present.

From the beginning of germination until the end of the process sugar is present in all parts of the haustorium except in the epithelium (fermentation layer), the layer beneath, the cells of which are continually dividing, and in the bundles.

The sheath of the cotyledon transports sugar to the embryo.

Sugar is stored as starch in definite parts of embryo and haustorium (Figure 3 Taf. IX, SACHS). After germination has begun tannin, is found everywhere but in the endosperm.

The second layer through division and also the third layer in part, are resposible for the growth of the haustorium during germination.

In the very beginning stretching is due to cells already formed in the embryo before germination.

The bundles of the haustorium are a continuation of those in the cotyledonary sheath; they are peripherally arranged.

The outer cell layer of the haustorium is a continuation of the epidermis of the cotyledonary sheath; the cells continue to divide all through the growth of the organ during germination.

It is this epithelium which is responsible for the absorption of the reserve material of the endosperm.

No sugar or starch is found in those cells.

With the growth of the haustorium the endosperm tissue in the vicinity is softened forming a zone.

A zone of crushed cells is present around the haustorium, composed of cells emptied of their contents whose primary walls only are seen. These primary walls can be followed into the yet intact part of the

endosperm. The zone of crushed cells composed of primary membranes grows wider with the absorption of the endosperm. The epithelium secretes a substance which digests the endosperm. Oil drops are very likely sucked up as such.

LLOYD ([19]) among many observations on the embryogeny of the date, which we shall not concern ourselves with here, adds materially to the picture of germination in the date.

He found masses of oil drops between the embryo and endosperm during the embryonic period and germination.

In the latter stage he believes it to be merely accidental as a result of the technique employed. He believes that the oil is made soluble and not sucked up as SACHS believed.

Although SACHS found no digestion of the primary walls of the cells of the endosperm, LLOYD states that during embryogeny the primary cells walls are digested by cytase which disappears soon after and does not reappear during germination.

LLOYD makes five zones of endosperm tissue instead of three as SACHS did.

a). Crushed cells from embryonic period.
b). Compressed cells of primary membranes — oil in minute droplets.
c). Zone where the oil in the cells is in the form of large single drops, protoplasm has disappeared and the reserve cellulose is less in amount.
d). Zone in which protoplasm is disappearing and the reserve cellulose begins to undergo changes.
e). Unchanged endosperm.

GREEN ([10]) had somewhat earlier than LLOYD maintained that in *Livistona humilis* a cytolytic ferment attacked the primary membrane and dissolved it.

Before considering the details of the haustorium and endosperm of *Elaeis* during germination, we must note a few more facts given by other investigators.

REISS ([28]) found reserve cellulose in the following palms *Phytelephas macrocarpa*, *Chamaerops humilis*, *Lodoicea Seychellarum* and *Elaeis guineenis*.

KOHL ([17]) found protoplasmic communication between the cells of the endosperm of *Phytelephas macrocarpa* and Coleococcus carolinensis.

WITTMACK ([42]) observed in the haustorium of the coco-nut a spongey tissue composed of stellate cells and also many air spaces. The cells of the periphery were smaller and free from starch grains and the cytoplasm denser. The inner cells contained many starch grains. The bundles in the haustorium were peripherally arranged.

NEWCOMBE ([24]) reported on the presence of a cytohydrolytic enzyme in the date. The extract of the date seedling acted freely on starch.

POND ([26]) showed that the endosperm of the date is incapable of self-digestion.

KRUIJFF ([18]) reported that the haustorium of the coconut contained lipase, protease, amylase, catalase and peroxidase.

Structure of the haustorium.

When the embryo is in the resting condition, that is when the fruit is already ripe, all the structures which are to function during the process of germination are already deliminated. That is especially true of the haustorium, all of whose elements are present before germination. Thus in cutting cross sections of the resting embryo one finds, as one approaches the juncture of haustorium with the cotyledon, the definite arrangement of the vascular bundles in a ring. In a longitudinal section the bundles are seen running to the very end of the cotyledon. These bundles at the opposite end are in communication with the embryo proper. In Figure 132, Plate XVI, ten bundles are seen arranged in a ring. This section was made from the neck-piece of the haustorium where it passes out of the germ pore. The bundles are most closely compressed in the canal running through the shell. Within the shell the bundles spread themselves out and also outside of the shell they are wider apart. In Figure 127 which is a longitudinal section through the seed and seedling three of these bundles can be followed from the haustorium into the vascular system of the seedling in an advanced stage of growth. The structure of the bundle in cross section shows an outer zone of cells polygonal in outline with thickened walls. This zone in some places is more than one cell thick. Within this zone are bast, xylem and phloem cells. In its general structure it is like the bundle described in the shell (Figure 79 Plate VIII). The outermost layer of the haustorium, the ferment layer or epidermis, is definitly deliminated in the resting stage of the embryo and can be seen as columnar cells with their long axes perpendicular to the long axis of the haustorium. Inside of this layer follow two or three layers of more or less cubical cells, then come bundle cells and in the center a parenchyma of irregular cells. The innermost tissue which is the spongey tissue of the growing haustorium does not show the inter-cellular spaces in the resting condition.

As soon as germination sets in changes are observed in the haustorium. Nuclear and cell division go on simultaneously in all parts of the haustorium, the most active division of cells takes place in the outermost layer and the two, three and sometimes more layers within. Notwithstanding the statements made by SACHS ([31]) and others that it is the outermost and the second layer that divides, I have been able to find nuclear and cell division in all the regions in a stage shown in Figure 128, Plate XVI.

The innermost tissue, the spongey parenchyma, in the very first stages of germination begins to expand so that inter-cellular spaces appear between

the cells. At first these spaces are small, but when the cells take on a stellate character they become considerably larger. The cells furthest away from the end of the haustorium are the largest. With the emergence of the cotyledon from the germ pore the constriction between the haustorium and the cotyledon becomes more pronounced and the epidermal cells of the haustorium, which in the resting stage are not sharply separated from the epidermis of the cotyledon, become so now. In Figure 128 which is a longitudinal section of an haustorium in a very early stage of germination all the above mentioned regions can be made out with but little difficulty. It is also to be noted that the bundles make a distinct zone of division between the spongey parenchyma and the most active meristematic region. The vascular system of the haustorium is always peripheral, no vascular elements ever pass into the spongey parenchyma.

If we examine the lobes in an early stage of germination we find that there is no spongey tissue element there and we also find that they are the seat of very active cell division.

The cells of the epidermis through their active division keep on adding more cells, keeping pace with the division in the interior of the haustorium. The cells inside of the epidermis divide to form the tissue of the bundles which enter the new lobes of the haustorium, and also the cells that form the spongey parenchyma of the growing organ.

The subsequent development of the haustorium is primarily an extension of the organ in all directions without entailing any profound modifications of the tissue. Lobes increase in number. Figure 129, Plate XVI, is a somewhat older stage than the one shown in Figure 128. The sides of the longitudinal section show the characteristic lobing. In a cross section of a still later stage (Figure 130) the lobes have increased in number. Into each lobe one or two branches from a bundle enter. The further increase in the lobes can be seen from Figure 131.

The meristematic tissue of the haustorium becomes more restricted as the haustorium grows. Whereas in the very early stage (Figure 128) a considerable portion of the haustorium is meristematic, in a stage represented by Figure 130 the cells of the outer two layers only are in active division. In a stage represented by Figure 131, the inner of the two layers has also ceased to divide. From that time on until the last of the endosperm is absorbed the haustorium grows mainly through the elongation of the cells of the periphery — that is the cells just within the Epidermis — and also because of the increase in the size of the inter-cellular spaces.

The distribution and arrangement of the spongey tissue is interesting to note. In Figure 139, Plate XVII, several of the cells taken from the interior of an haustorium are seen. The cells are more are less irregularly stellate in character allowing for large spaces between the cells that come in contact with each other. The long axis of such a cell usually runs parallel with the long axis of the haustorium. In the lobes the spongey

tissue takes on a definite arrangement, the vascular bundle serving as a center around which the tissue orients itself. Such a lobe is seen in Figure 140, Plate XVII. Roughly analyzed the bundle is the center, then follows a ring of cells completely encircling the bundle. From this ring rows of cells like the spokes from a hub radiate. These rows may be one, two or three cells in length. Encircling these radiating cells like the rim of a wheel are additional cells. Then follow one or more layers of encircling cells or radiating cells in part and finally the epidermal layer. The innermost cells show the greatest degree of expansion, the outermost cells are still capable of expanding so that subsequent growth of the lobe mey be merely the result of increase in the size of the inter-cellular spaces.

The fully grown haustorium is a very light object. Its spongey character can be readily seen with the unaided eye when it is cut through with a knife and the zones too are discernable. Figure 110, Plate XII, brings out the spongey zone represented by the dotted area and the outer zone composed of the epidermis, the meristematic layers and vascular bundles.

Ferment and meristem cells.

These cells were clearly described by SACHS ([31]) and it is surprising how closely the cells of the haustorium of *Elaeis* resemble those described by SACHS for *Phoenix*. In their arrangement the layers differentiate themselves from each other. Thus the cells of the outermost layer show a distinctly epidermal character. In the resting embryo as we have already stated, no sharp line can be drawn between these cells of the haustorium and the cells of the cotyledonary sheath. The meristematic cells of the next layer are in the main cubical and those of the third layer run with their long axes parallel to the long axis of the haustorium. Figure 112, Plate XIII is from a section of a stage of the haustorium shown in Figure 128, Plate XVI. The row of cells to the right shows the columnar epidermal cells, the so-called ferment cells, whose function undoubtedly is associated with enzyme secretion. As can be seen from the plate their tendency is to be rectangular and it truly merits the name columnar epidermis or epithelium. The free ends of the cells of the epidermis are rounded whereas the other end may be angular when the cells come in contact with irregularities in the cells of the inner layer or they may also become wedge-shaped as the third cell from the bottom of the layer shows. The nucleus is always centrally located, agreeing with REED's ([27]) observations in *Phoenix dactylifera*. The cytoplasm is dense and very granular with many large and small vacuoles scattered within it. The vacuoles show no selective arrangement in the cell. In one cell the larger vacuoles appear at the distal end, in another cell at the proximal end, in still others at both ends and lastly they may cluster around the nucleus.

The larger granules in the cytoplasm, a common phenomenon in the cells described above, can hardly have the significance ascribed to them by several investigators who claim for them zymogenic properties, since in later stages, although endosperm digestion is in full swing, these large granules have disappeared.

There is no evidence of starch grains in these cells at this stage. Active nuclear and cell division go on and the plane of division of the cell is always in the long axis of the cell. Simultaneously with active secretion and absorbtion these cells multiply. Much has been ascribed to the nucleus as that part of the cell around which the activities center. We have evidence however, that the cells in diverse stages of karyokenesis still carry on all the functions of secretion, digestion and assimilation. In stages of preparation for nuclear division, for chromosomal separation and distribution, as one can see from Figure 112, there is apparently no diminution in the activitity of the cytoplasm. In the epidermal cells secretion undoubtedly goes on, and in the meristematic cells, even in the ones where the chromosomes are seen in polar view of the equatorial plate, and the equatorial plate, the cytoplasm and its starch grains do not differ from the cytoplasm in the resting condition.

The cells of the next two layers, the meristematic cells in contrast with the outer layer of cells, show a much lighter staining cytoplasm. This is immediately apparent when one examines a preparation even with a low magnification. The inner cells differ form the outer cells also in size, in form, and in the presence of starch grains. It is interesting to note in these three layers — the absence of starch grains in the outermost layer, the presence of many small starch grains in the second layer and the presence of many large starch grains in the third layer.

As the haustorium continues to grow the cells of the epidermis become smaller, the cytoplasm less dense and the cells, beside carrying the function of secreting enzymes for endosperm digestion, begin also to store up countless numbers of minute starch grains. The dots within the cells of the outermost layer shown in Figure 140, Plate XVII, show their relative distribution. In Figure 142, which shows a row of those cells, they are seen as small circles and in Figure 143 they are seen in greater magnification.

The presence of starch grains in the outer layer of the haustorium of *Elaeis* is interesting in view of the absence of starch grains in this layer in *Phoenix* as described by SACHS and by REED. In contrasting the two cells, the one shown in Figure 112, Plate, XIII, with that of Figure 143, Plate XVII, the modifications that have taken place are most significant. The cell shown in Figure 143 was drawn from a stage where only half of the endosperm had been absorbed so that there could be no question of loss of function having taken place. Simultaneously with the secretion of enzymes these cells carry on the synthetic process of starch formation.

The cytology of digestion.

In physiological processes in animals or plants, chemical and mechanical indicators are employed to help form a mental image of the process or the results of a process. Thus efforts have been made to perfect self recording devices for such purposes. The cytologist has tried to reconstruct from his fixed and stained material the steps in a process; he employs his so-called stages as indicators. The steps in nutrition because they are so difficult to record have left an open and rich field to the investigator. Unfortunately the work that has been done in that field is yet meagre. SACHS' work on germination is illuminating not only because it has explained the chemical processes involved, but also because he was able to show, through the medium of the cells of the haustorium or scutellum and the endosperm, the steps in the peculiar relationship between seedling and haustorium on the one hand, and the endosperm, the store-house of food, on the other.

The embryo of Elaeis in the resting condition contains neither sugar nor starch. If the embryo is examined directly after the fruit is ripe traces of sugar and starch can be found. These however disappear soon after. The activities of the embryo before it is allowed to germinate are reduced to the minimum. I have been able to prove to myself however that in the so-called resting state of the embryo some of the cell contents of the endosperm tissue in the immediate vicinity of the haustorium have been used up.

When germination sets in the embryo begins to expand so that it fits snugly in its cavity. The haustorium becomes active and attacks the surrounding tissue. The cavity in such a stage, when the embryo has been removed, shows the negative counterpart of the outlines of the haustorium. On the other hand the haustorium and the embryo proper show the presence of starch grains scattered throughout the tissue, however as we shall see, with a definite kind of regularity.

Before considering the further steps in the process, attention should be called to the structure of the starch grains found in the cells of the haustorium and embryo. The grains vary in size as we have seen in Figure 112, Plate XIII. In their general structure they are oval or round. The hilum is centrally located, usually it is tri-radiate — occasionally it is four radiate. Surrounding the hilum is a halo whose radius does not exceed the radius of the limbs of the hilum. The starch grains may or may not show concentric zones. The starch grains may appear singly or in units of two and three. In such cases they become polygonal. When the starch grains are closely packed in a cell they become polyhedral (Figure 141, Plate XVII.)

The structure of the cell walls of the endosperm tissue must be briefly mentioned. The presence of primary membranes, used in the sense that SACHS has used the term, can readily be seen and also the thickenings

which contain the so-called reserve cellulose are evident. Figure 145, Plate XVII shows several of these cells in longitudinal section. The intercommunicating pits are also shown. In cross section these cells show a polygonal outline with strongly thickened walls and pits. These cells are filled with fats, oils, aleuron grains and the proteins from the cytoplasm and nucleus. The endosperm cells to-gether with their contents supply the embryo with hydrocarbons, carbohydrates and proteins.

In the process of germination we have two contrasting phenomena — an endosperm which is gradually diminishing and an haustorium that is increasing in size. These, as we know, are correlated phenomena.

The endosperm through its zones, through the state of the cell walls and through its oil or fat drops and aleuron grains registers the processes of dissolution of the tissue.

If a seed is cut through in a stage of germination two distinct zones can be made out with the naked eye. Such zones can be seen in Figures 102 to 105 Plate XI and Figures 127 and 130, Plate XVI. The sharp line of demarcation between the two is striking. The inner zone — the one near the haustorium, is of a soft cheesey consistency, the outer zone is quite solid and resistant.

If we now examine the cells of the endosperm in such a condition we find a corresponding difference in the cells too. Figure 144, Plate XVII is a section of the endosperm in a stage shown in Figure 130, Plate XVI. The lower dotted zone is the cork layer, the next zone is that of the intact cells, the third zone with the large fat or oil globules and the empty cells is the soft zone that we have mentioned above. The difference in the two zones lies primarily in a difference in the amount of cellulose. In the soft zone much of the so-called reserve cellulose has been removed from the walls, the middle lamellae too have disappeared so that the cells are no longer rigid and thus they form a soft tissue.

There can be no doubt that the protoplasmic communication between the cells which KOHL ([17]) has described in the endosperm cells of *Phyteleyhas macrocarpa* and *Coleococcus carolinensis* are also to be found in the cells of *Elaeis*. These protoplasmic bridges are digested so that passage of drops of oil or fat is facilitated through the pits, accounting for so large an accumulation of drops in that region. A free hand section of the endosperm stained with Sudan III, brings out in a most striking fashion these zones. This can be made out with the naked eye.

If we examine the cells more critically we find that the aleuron grains also act as indicators. In the zone where active digestion is going on there are fewer grains. In sections from material which has been imbedded in paraffin and has been run up through the various percents of alcohol and then into xylol, the fats and oils are naturally absent. The aleuron grains apparently remain unaltered, at least their distribution corresponds

to the zones. In the emptied and crushed cells isolated grains may occasionally be found.

The cell walls show characteristic changes. In direct contact with the haustorium is a mantle or zone of crushed cells which can hardly be recognized as cells. These cells have all lost their wall thickenings and what remains are the shrunken primary walls.

The cells pass gradually into cells that show various stages of cell wall dissolution. The cells are just beginning to be crushed due to the pressure exerted by the expanding haustorium and because of their loss of wall reinforcement. In cross section in this stage, these cells form a net like structure — the cells are diamond shaped.

The cell walls of the unsoftened tissue show no changes but with the gradual encroachment of the haustorium they will pass through the same changes described above.

From an examination of the zones of the endosperm one can readily visualize the process of dissolution. It is decidedly obvious that the enzymes secreted by the haustorium act opun a zone for some distance beyond the region of their origin as we can seen from the zones. The pectinase and cytase, if these be the enzymes that are responsible for the dissolution of the middle lamellae and reserve cellulose respectively, have begun to act before the cell contents have been absorbed by the haustorium. Proteolytic and lipalytic enzymes pass beyond the active zone of absorption, preparing in advance the food for the haustorium.

The endosperm through its cell walls, through its aleuron grains and oil drops indicates the processes of digestion going on.

The crushed primary cell walls are absorbed and they are not pushed ahead of the haustorium to remain undigested as described for grasses and *Phoenix*. This agrees with GREEN's ([10]) observations in *Livistonia*. Moreover the region of cell walls directly in contact with the haustorium gives distinctly the sugar reaction with Fehlings solution.

The crushed cells are in direct contact with the haustorium and they are found closely pressed against the lobes and in the spaces between the lobes (Figures 130 and 131, Plate XVI). In Figure 142 intimate relationship is shown between these crushed cells and the haustorium. The cells of the outer layer can be seen in the rôle of digesting the cell walls and storing up starch grains.

After the endosperm is absorbed the space is occupied by the haustorium. Nothing remains but the cork zone with the irregular ends of a few cells.

The starch grain serves as an indicator of the processes going on within the haustorium and the embryo proper. The size, the form and the condition of the starch grains is employed for that purpose. Attention must be called here to the starch grains that are being inverted into sugar. The action apparently begins from the hilum and radiates outward (Figures 137 and 138, Plate XVII).

We have seen from Figure 112, Plate XIII that in an early stage of germination the substances that are to be secreted as starch pass through the epidermal layer and these are laid down as starch grains in the inner layers. The second layer contains smaller starch grains than the third layer in which the starch grains are strikingly large. In such a stage the presence or absence of starch grains indicates the activities of the cells. The starch grains in that region show no corrosions. The starch at this stage is stored in the cells.

If we examine the distribution of the starch grains in the whole embryo at this stage (Figure 128, Plate XVI), we find that although starch is found everywhere in the haustorium and in the embryo proper (not shown in this figure) the densest zone is roughly between the outer layer and the vascular bundles. This zone also coincides with the zone of active cell division. In the other regions the starch grains are fewer. As one approaches the embryo proper the starch grains show corroded areas. It is to be remembered that in this stage most of the activities of the embryo are in the region of the haustorium. In the other regions the activities are very slight. More starch is being stored up than is being used. The condition of the starch grain gives an index of the regional activity of the embryo.

When the cotyledon has passed through the germ pore and the radicle has burst through the sheath, digestion of the starch grains becomes more pronounced judged from the condition of the starch grains. In later stages when the meristem, under the epidermis has ceased to divide, storage and translocation of starch are still active (Figure 141, Plate XVII). The presence of starch grains in the epidermis of the haustorium where before no starch grains appeared indicates a profound change in the physiological properties of the cells.

The micro-chemical tests employed for the determination of the changes of the oil, fats, and proteins have not been recorded in these observations.

We have cited only a few of the physiological processes which the endosperm and the haustorium register. Micro-chemical tests coupled with these obvious microscopical and macrocopical indicators will present an even clearer picture of the physiology of the process.

The haustorium in its structure, its bundles arranged in a ring the character of its epidermis and its absorptive function, corresponds more closely to the root than to any other organ of the plant. This is not said however with the idea of defending the view that it is a modified root.

Summary.

1). The form of the haustorium depends upon its position with reference to the endosperm and also upon the form of the endosperm.
2). The ultimate size of the haustorium depends upom the size of the endosperm.

3). Growth of the haustorium is due to the outer three or four layers. The outermost layer gives rise to epidermal cells, the other layers give rise to more meristem, vascular bundle cells and spongey parenchyma cells.
4). Ferment or epidermal cells in the beginning stages contain no starch grains.
5). Cells of the meristem store up starch.
6). Later stages of epidermal cells of haustorium contain many starch grains.
7). The physiological processes involved in germination can be followed by means of such indicators as the zones of the endosperm, the cell walls, aleuron grains, oil or fat drops, starch grains and cytoplasm.

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Explanations of Plates.

PLATE I.

Fig. 1. Developing leaf showing horizontal plane from which the segments running vertically arise. Segments do not run through to the periphery of blade. × 80.
Fig. 2. Stage like above showing the tip ending in a number of branched hairs. × 80.
Fig. 3. Later stage, segments have become triangular in form — only 6 segments on one side of the leaf. × 80.
Fig. 4. Plane of origin of the leaflets shifting to the vertical — these leaves will develop into pinnate leaves with the indicated number of pinnae. × 80.
Fig. 5. Ditto. × 75.
Fig. 6. Young leaf with increasing number of leaflets. The tip is still strongly developed. In the unfolded state the tip will be characteristically dichotomous. × 75.
Fig. 7. Lanceolate leaf of the young seedling showing no outward segmentation. × 1.

PLATE II.

Fig. 8. Young developing leaf with part of sheath cut away to show the cone shaped character of the leaf. The two halves of the blade showing the slits are seen, also the bonnet like appearance of the part of the leaf bearing the leaf blade. From a plant $1^1/_2$ years old. × 60.
Fig. 9. The same leaf in front view. × 60.

Fig. 10. A somewhat older leaf seen from the front. The leaflets are definitely deliminated. The inverted Y is the strip which holds the leaflets together by their apices. The two arms of the Y are attached to several of the lower leaflets in the respective halves of the leaves. The leg of the Y marks the boundary line between the upper leaflets of the respective halves. × 60.

Fig. 11. Like Figure 10 but seen from the side. Note parallel arrangement of leaflets. × 60.

Fig. 12. A still later stage. Leaflets have begun to shift upwards. Note the criss-cross arrangement of the fibres in the sheath and the parallel arrangement of the fibres in the petiole. × 25.

Fig. 13. Later stage showing the leaflets obliquely arranged. Near the base of the leaf blade more leaflets are being added. Strip holding leaflets seen to the right. × 25.

Fig. 14. A still later stage with leaflets showing various stages of elongation. × 1.

Fig. 15. Portion of leaf from two year old plant in same stage of development as Figure 14, showing the prolongations from the leaflets at S. These prolongations are made up of the tissue of the leaflet proper and the remains of the strip. × 30.

Fig. 16. Half of a leaf blade showing the "Wülste" of NAUMANN and the slits of VON MOHL. The parallel arrangement of the leaflets and the strip holding them to-gether is seen. × 90.

Fig. 17. Several leaflets from stage in Figure 16. × 100.

Fig. 18. Longitudinal cut through leaf from 5 year old plant showing the large number of leaflets in one half of a leaf. Strip is prominent. Note the shifting of the plane of position of the upper leaflets in contrast to the youngest and smallest one. × 25.

Figures 19, 20, 21. Leaflets showing triangular form. × 30.

PLATE III.

Fig. 22. Longitudinal section through growing point and leaves in various stages of development. The $^3/_8$ arrangement accounts for the various appearances of the leaves AA, BB, CC, DD, etc., parts of individual leaves. × 60.

Fig. 23. Longitudinal section through growing point showing origin of leaf 'Anlagen' meristematic regions designated by the denser areas. × 90.

Fig. 24. Leaflets in various stages of progressive splitting. It also shows the older leaflets shifting from the horizontal to the vertical. Lower and younger leaflets still horizontal. × 120.

Fig. 25. Section of a lower portion of a leaf blade showing splitting of leaflets. × 120.

Fig. 26. Leaflets splitting. × 120.

Fig. 27. Leaflets developing within tissue of mother leaf.
Taken from a stage like GG in Figure 22. × 160.

Fig. 28. The next older leaf after the one in Figure 27, represented by HH in Figure 22. The leaflets are seen within the tissue of the leaf blade. The bounding area of the leaflets is the epidermis. Bundles connect with the leaflets. × 160.

PLATE IV.

Fig. 29. Growing region with youngest leaf 'Anlage'. The more strongly dotted area shows the region from which the next leaf is to be cut off. × 60.

Fig. 30. Young leaf 'Anlagen' seen from above showing beginning of growth of the ends until they ultimately meet. × 60.

Figs. 31 and 32. Sections showing crescent-shape of the young leaves. × 30.

Fig. 33. Cross section through a young leaf showing three pairs of leaflets. This due to the fact that leaflets are already pointing obliquely upwards closely pressed to-gether arranged upon the rachis in a shingle like fashion so that they overlap. A section through such an arrangement cuts through several pairs of leaflets. The leaflets are still angular. × 30.

Fig. 34. Cross section through somewhat older leaf. × 30.

Fig. 35. Cross section in same stage as above but more highly magnified. Leaflets although undifferentiated are split. These are held to-gether in part by the original enveloping tissue, the cells of which are seen here running in a vertical direction. This tissue is seen in upper left hand side of the figure. × 80.

Fig. 36. A later stage in cross section where the leaflets have elongated and lost their angular character. These leaflets are still held to-gether. × 30.

PLATE V.

Fig. 37. Longitudinal section of growing point and young leaflets. In the outermost leaf the leaflet 'Anlagen' are seen as aggregates or cushions of cells. × 80.

Fig. 38. A cushion or cell aggregate more highly magnified. × 250.

Fig. 39. Section showing the 'Anlagen' in a more advanced stage, seen here as a wavey line. The cells of surrounding tissue above distinct. × 80.

Fig. 40. Another section of the same leaf showing the cells surrounding the leaflets much larger. × 80.

Fig. 41. A tangential section through an older leaf, the ends of the leaflets seen. × 80.

Fig. 42. Section through leaflet showing sac-like character. × 60.

PLATE VI.

Fig. 43. Two year old plant with several leaves removed to show distribution of the fibres and also the sheath with its criss cross fibres going over into a dry leathery condition. × 1.

Fig. 44. Sheath in young stage of development. × 20.

Fig. 45. From above sheath at YY showing parallel arrangent of cell rows. × 120.

Figures 46 to 50. Stages of development of hairs of the sheath. × 450.

Fig. 51. Full grown hair. × 450.

Fig. 52. Minute stomata on inner surface of sheath. × 450.

PLATE VII.

Fig. 53. Longitudinal section through secondary root and cross section through the mother root. Secondary roots and pneumathodes originate endogenously in exactly the same way. The large air chambers arise long before the secondary root structures. × 100.

Fig. 54. Section a little beyond the growing point of the root showing the radial arrangement of the parenchyma just prior to the formation of air chambers. × 100.

PLATE VIII.

Figures 58 and 59. Cross and longitudinal sections of thick shelled fruit. × 1.
Figures 60 and 61. Cross and longitudinal sections of medium thick shelled fruit. × 1.
Figures 62 and 63. Cross and longitudinal sections of thin shelled fruit. × 1.
Figures 64 to 67. Cross sections of thin shelled forms showing distribution of the fibres outside the shell × 1.
Figures 68 and 69. Cross and longitudinal sections of *pisifera* fruit. × 1.
Figures 70 to 75. Cross sections through various levels of the pisifera fruit. × 6.
Figure 76. Portions of a thin shell, × 6.
„ 77. „ „ a medium shell. × 4.
„ 78. „ „ a thick „ × 4.
„ 79. Bundle from shell. Outer zone of thickened cells — inner zone of bast and central zone of conducting tissue. Some stone cells are seen surrounding the bundle. × 120.

PLATE IX.

Fig. 80. Section through endosperm and surrounding structures of a *pisifera* fruit. Description in text. × 120.

PLATE X.

Fig. 81. Longitudinal section of mature seed showing the position of the embryo near the germ pore. × 1½.
Fig. 82. Embryo in resting condition. × 40.
Fig. 83. Embryo showing haustorium enlarging. × 1½.
Fig. 84. Embryo of the above magnified. Constriction in the middle more pronounced. × 40.
Figs. 85 to 94. Various stages in germination. Shell removed to show the growth of the haustorium. × 1.
Fig. 95. Radicle bursting through sheath tearing it in a regular fashion. × 25.
Figs. 96 and 97. Side and under view of the operculum. × 25.

PLATE XI.

Figs. 98 to 101. Seeds with 1, 2, 3 and 4 seedlings respectively. × 1.
Figs. 102 to 104. Seedlings with haustoria; 1, 2 and 3 haustoria in the seed respectively. × 1.
Fig. 105. Part of the shell and endosperm removed to show the end of an haustorium and its zone of activity. × 2½.

PLATE XII.

Fig. 106. Seedling with two functioning leaves, still attached to the seed. × 1.
Fig. 107. Half of shell removed to show complete absorbtion of endosperm. The haustorium shows no sign of degeneration. × 1.
Fig. 108. Seedling with unfolding leaf and still attached to haustorium. The shell has been removed to show the form of the haustorium. × 2½.

Fig. 109. Another view of the above haustorium with the constriction showing. The parallel ridges of the haustorium are also seen. × 2½.

Fig. 110. Cross section of the haustorium. Dotted area is the spongey tissue, the peripheral zone of several cells in thickness, the active digestive and absorptive zone. × 2½.

Fig. 111. Haustorium with the neck-piece showing the flattened upper portion. × 2½.

PLATE XIII.

Fig. 112. Section of growing haustorium taken from a stage shown in (Fig. 128 Plate XVI) shows the three outermost layers in an active state of division. The outermost cells are devoid of starch grains; the cytoplasm is denser with many large and small vacuoles. The middle layer with many small starch grains has a decidedly lighter staining cytoplasm. In the third layer the long axis of the cells is in a vertical plane. The starch grains are strikingly larger. Fixed in Juel's Solution and stained with Heidenheins haematoxylen. Zeiss Oc. no. 4 × Obj. N. A. 1.3, Abbe Camera lucida.

PLATE XIV.

Fig. 113. Sector of a cross section of a root the next stage in the formation of the air chambers shown in Figure 54, Plate VII. They originate always radially but apparently with no definite regularity. × 160.

Fig. 114. Sector of a cross section of a root showing fully formed air chambers with lamellae ranging from 1 to 6 cells in thickness. Torn cells line the air chambers. × 160.

Fig. 115. Sector of a cross section of an adventitious root. The air chambers are smaller, more compressed. Hypodermis is strongly developed and the bast cells occupy most of the region previously composed of thin celled parenchyma. The cells of the endodermis are greatly thickened however the circle of endoderm is not continuous, the breaks made up of thin walled cells allow for ready communication between the central cylinder and cortex. Stone cells are strongly developed in a zone outside of the endodermis. The large oval cells in the cortex near the hypodermis are the raphide cells. × 160.

PLATE XV.

Fig. 116. Part of cross section of a root showing large epidermal cells, beginning of hypodermis, parenchyma, a single raphide cell in the center of the section and bast cells. × 600.

Fig. 117. Epidermal cells in longitudinal section. × 600.

Fig. 118. Group of bast cells. × 600.

Fig. 119. Longitudinal cut through a young plant cutting through several roots showing the presence of lacunae. × 2.

Fig. 120. Longitudinal cut through somewhat older plant showing the relation of the vascular system to the roots (the bundles run to the base where the roots emerge). × 2.

Figure 121 to 126. Showing adventitious roots in various espects. In Figure 124 the emergence from the branch to the right is a pneumathode. × 1.

PLATE XVI.

Fig. 127. Longitudinal cut through seed and seedling showing the connection between the vascular system of the plant and the haustorium. The bundles passing from the neck-piece into the haustorium are peripherally arranged in the haustorium. × 1½.

Fig. 128. Longitudinal section through an haustorium showing the various zones. Explanation in text. × 120.

Fig. 129. Longitudinal section of haustorium and seedling. Lobed character of haustorium more pronounced. Explanation in text. × 60.

Fig. 130. Cross section through endosperm and haustorium. Explanation in text. Note the zones in endosperm. × 60.

Fig. 131. Like above, but later stage. × 60.

Fig. 132. Cross section through neck-piece of haustorium showing the bundles in a ring. × 80.

Fig. 133. Vascular bundle magnified agreeing in the main with the bundle in the shell (Figure 79, Plate VIII). × 120.

PLATE XVII.

Figs. 134 to 136. Starch grains stored in the haustorium. They do not show corrosion. × 800.

Figs. 137 and 138. Starch grains stored in haustorium beginning to be corroded. × 800.

Fig. 139. Cells of the interior of the haustorium showing the nature of the intercellular spaces. Explanation in text. × 600.

Fig. 140. Lobe of an haustorium in an advanced stage of growth showing the cells of the interior radiating from the bundle. The cells are gorged with starch grains. The outermost layer — the fermentation layer shows the presence of very many tiny starch grains represented here by dots in the cells. × 80.

Fig. 141. Single cell directly behind the fermentation cells gorged with starch grains. Many of these are polygonal due to mutual pressure. The starch grains show evidence of corrosion. × 600.

Fig. 142. Cells of the fermentation layer with the remains of the cell walls of the haustorium closely pressed against them. Explanation in text. × 250.

Fig. 143. Cell from fermentation layer taken from a stage shown in Figure 142. Explanation in text. × 800.

Fig. 144. Part of endosperm in stage of being digested. Taken from stage seen in Figure 130, Plate XVI. Explanation in text. × 60.

Fig. 145. Cell walls of cells of endosperm. × 450.

Fig. 146. Cells ot cork layer around endosperm. × 250.

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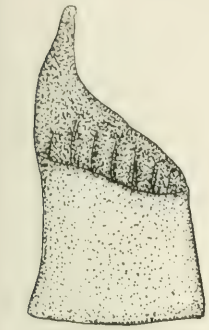

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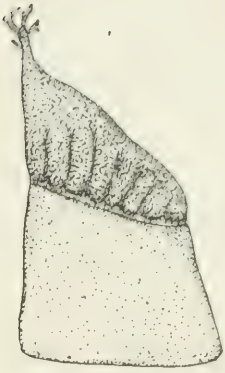

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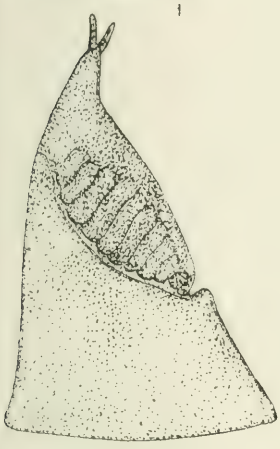

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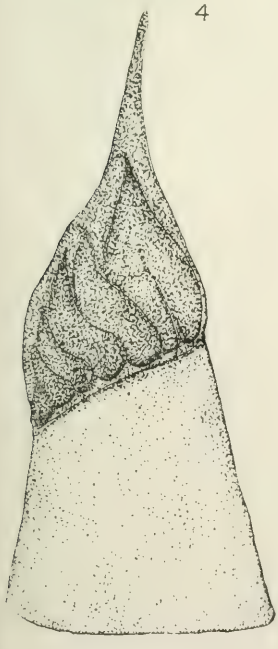

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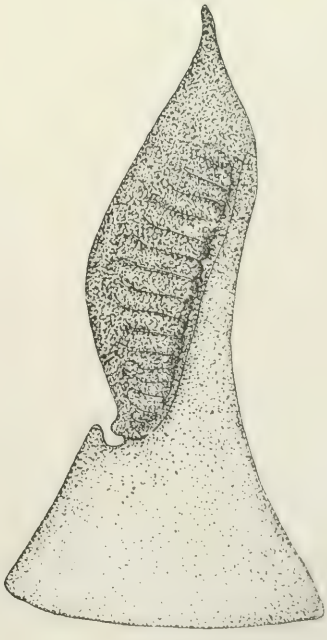

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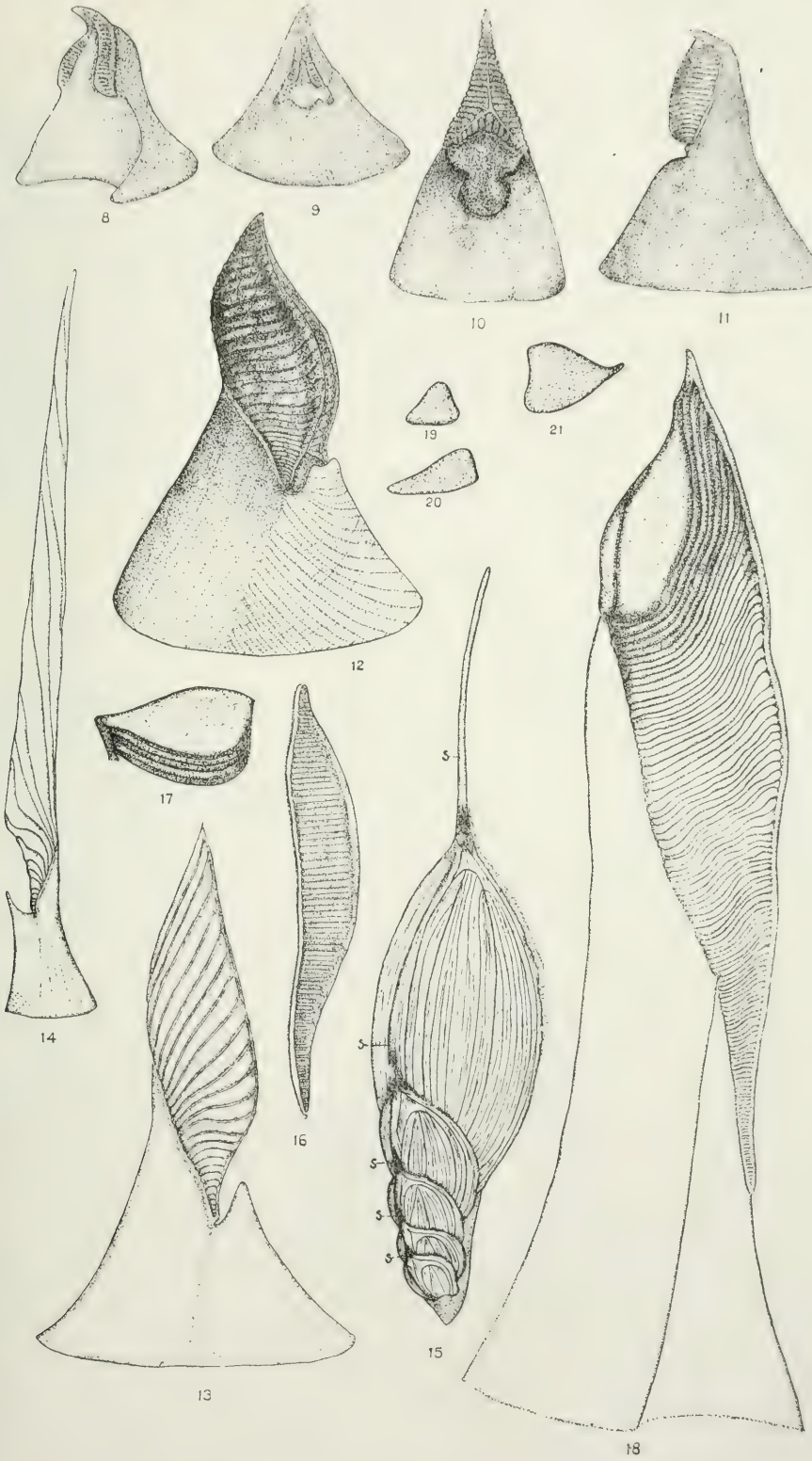
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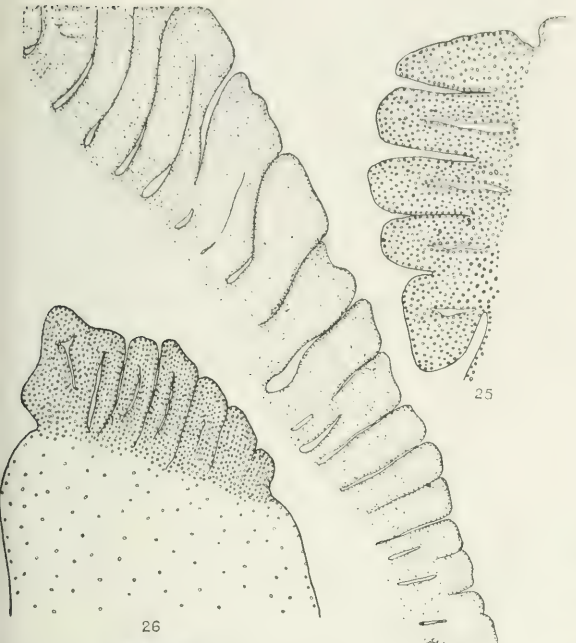
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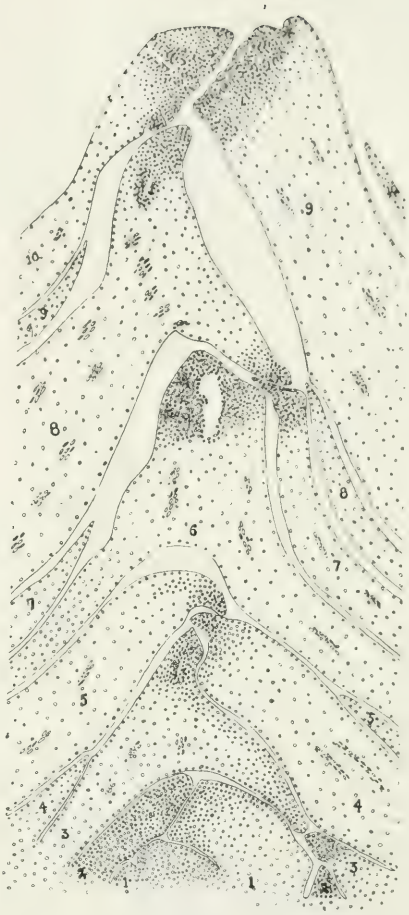
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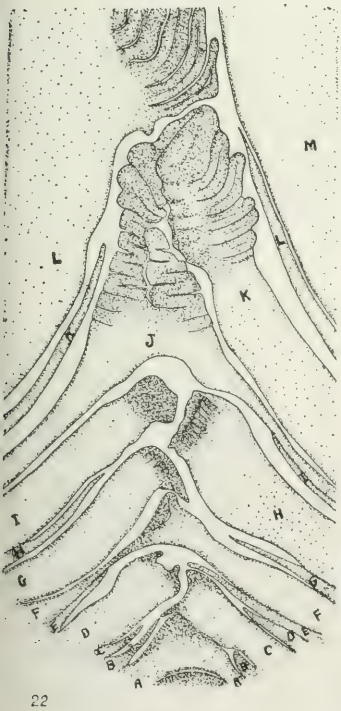
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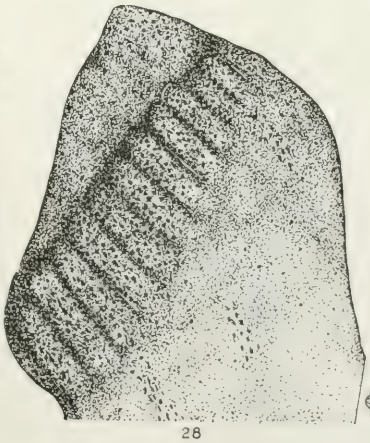
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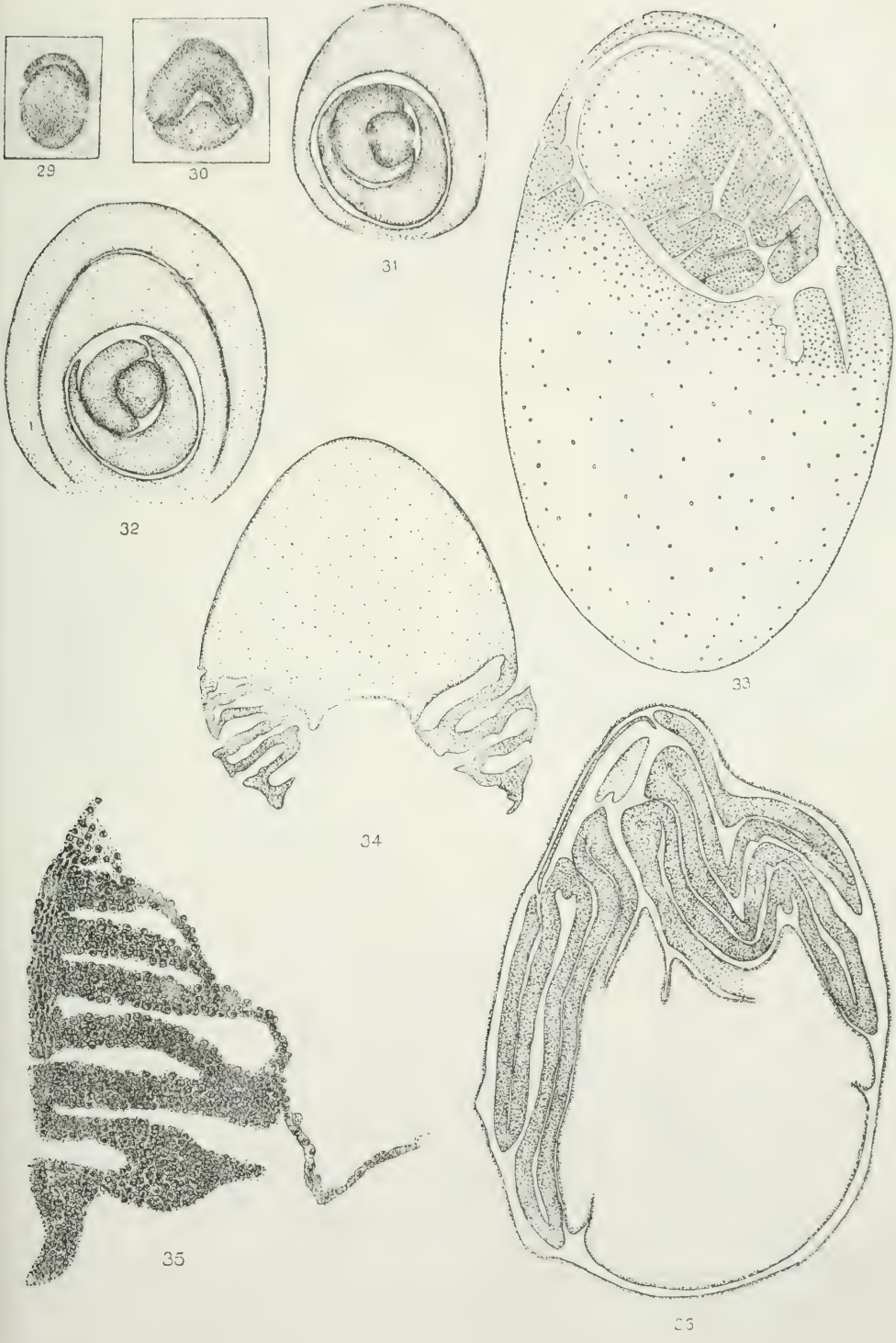
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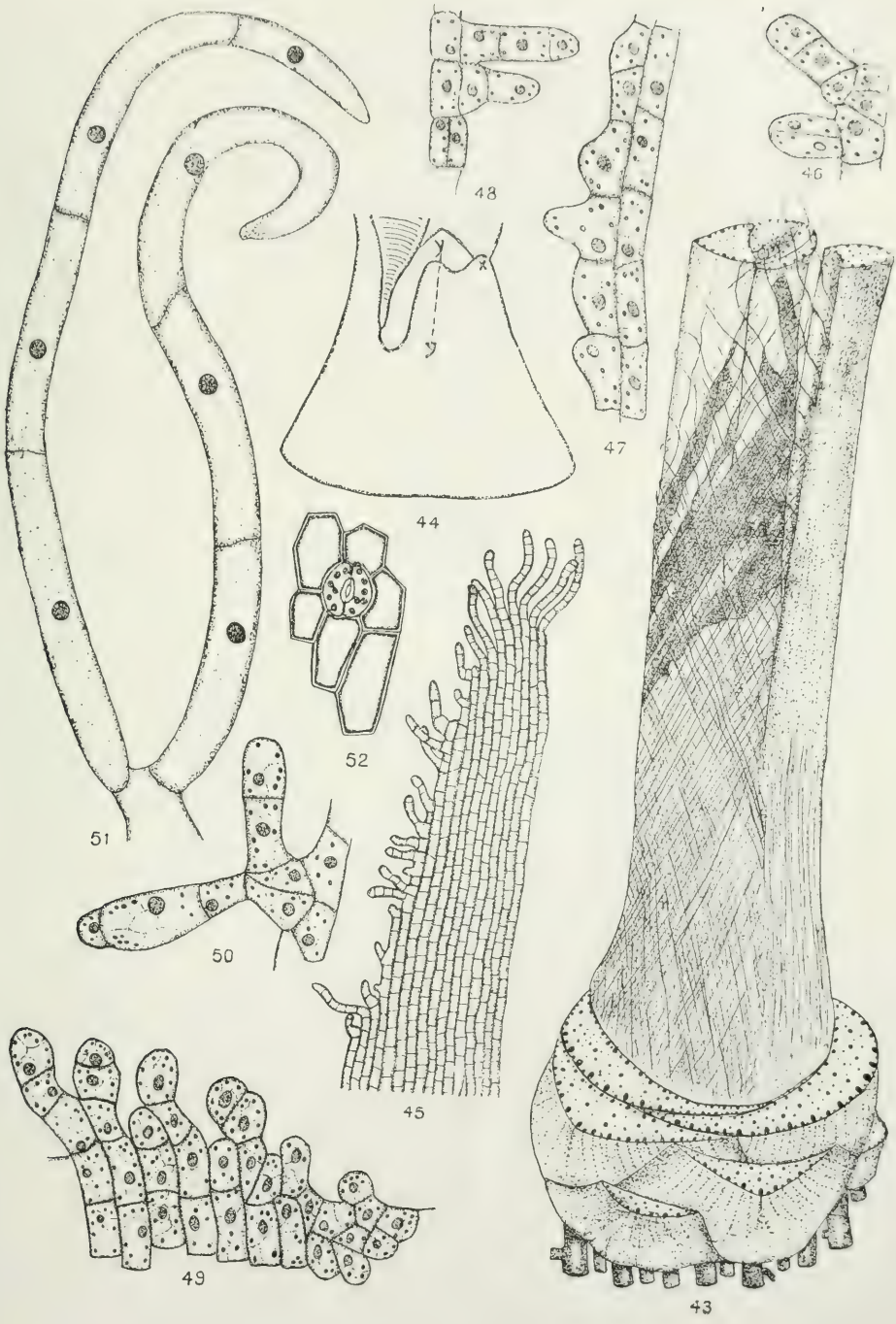
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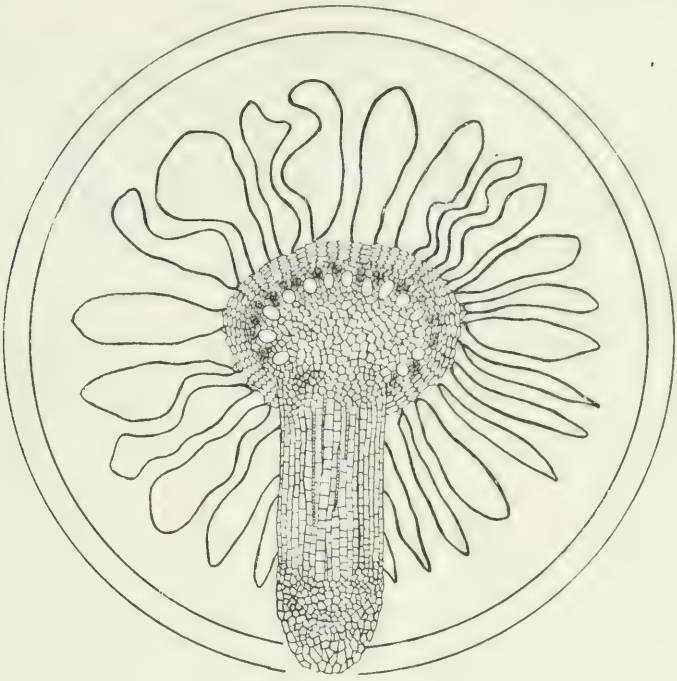

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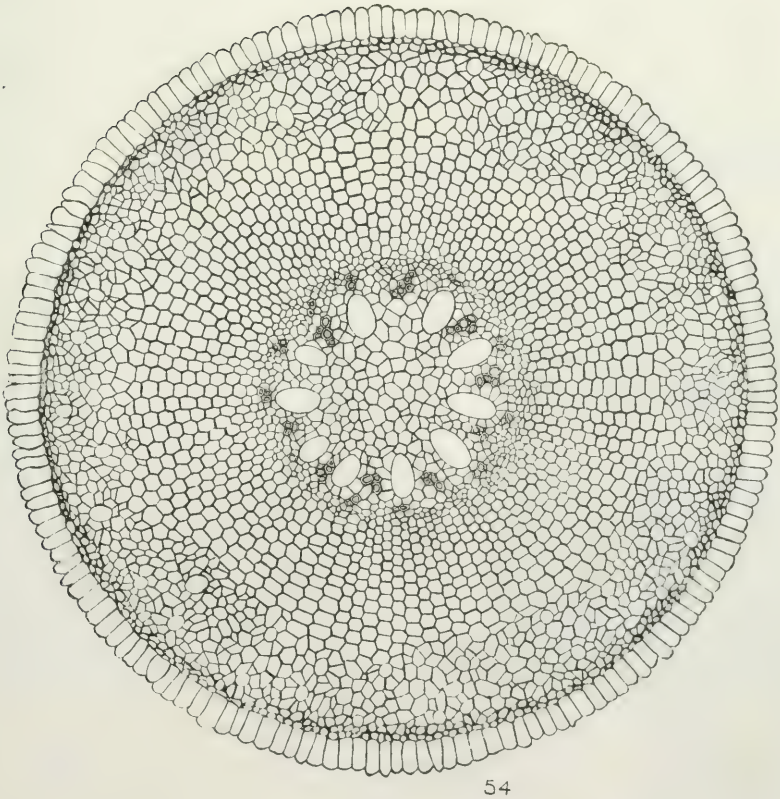

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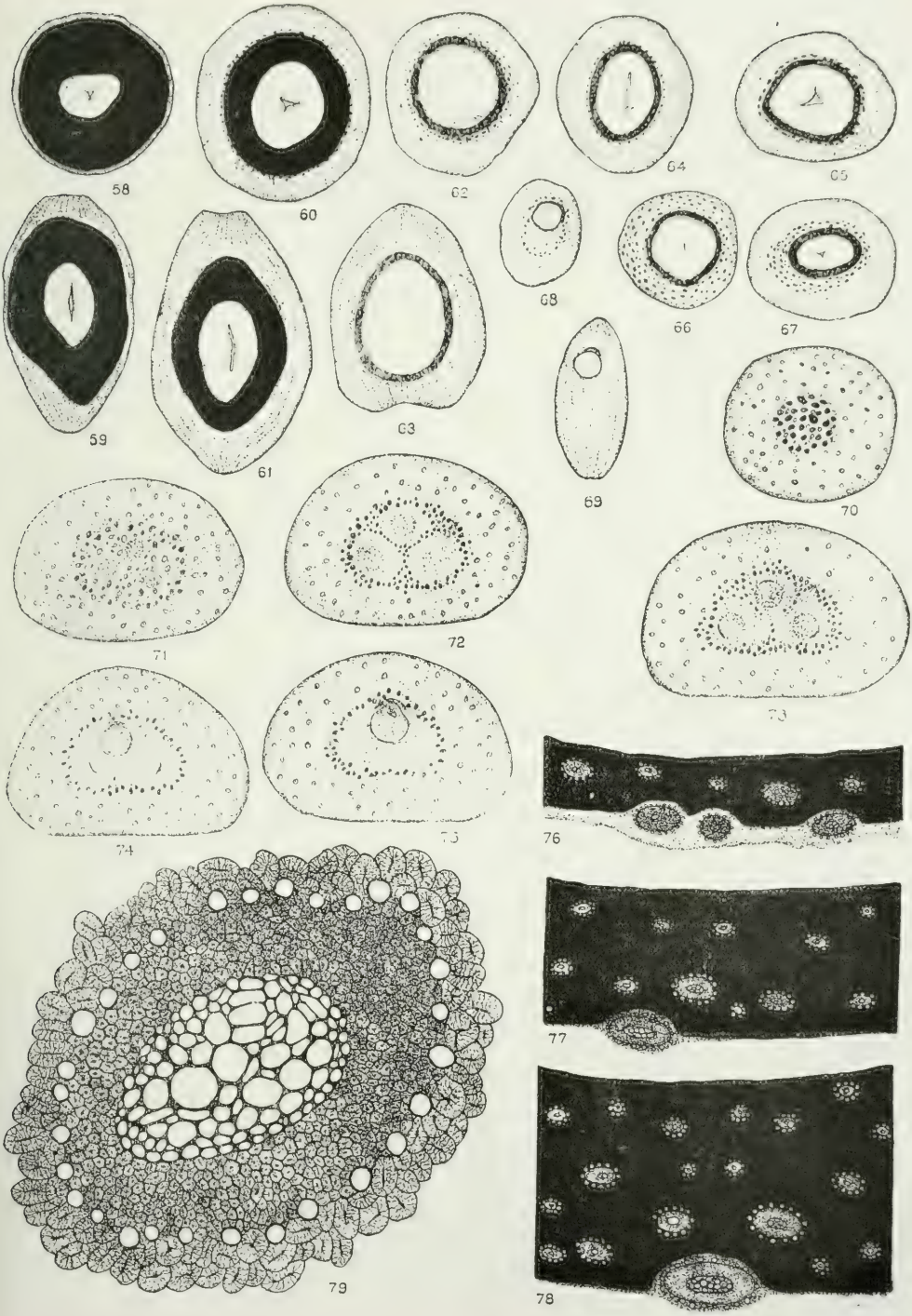
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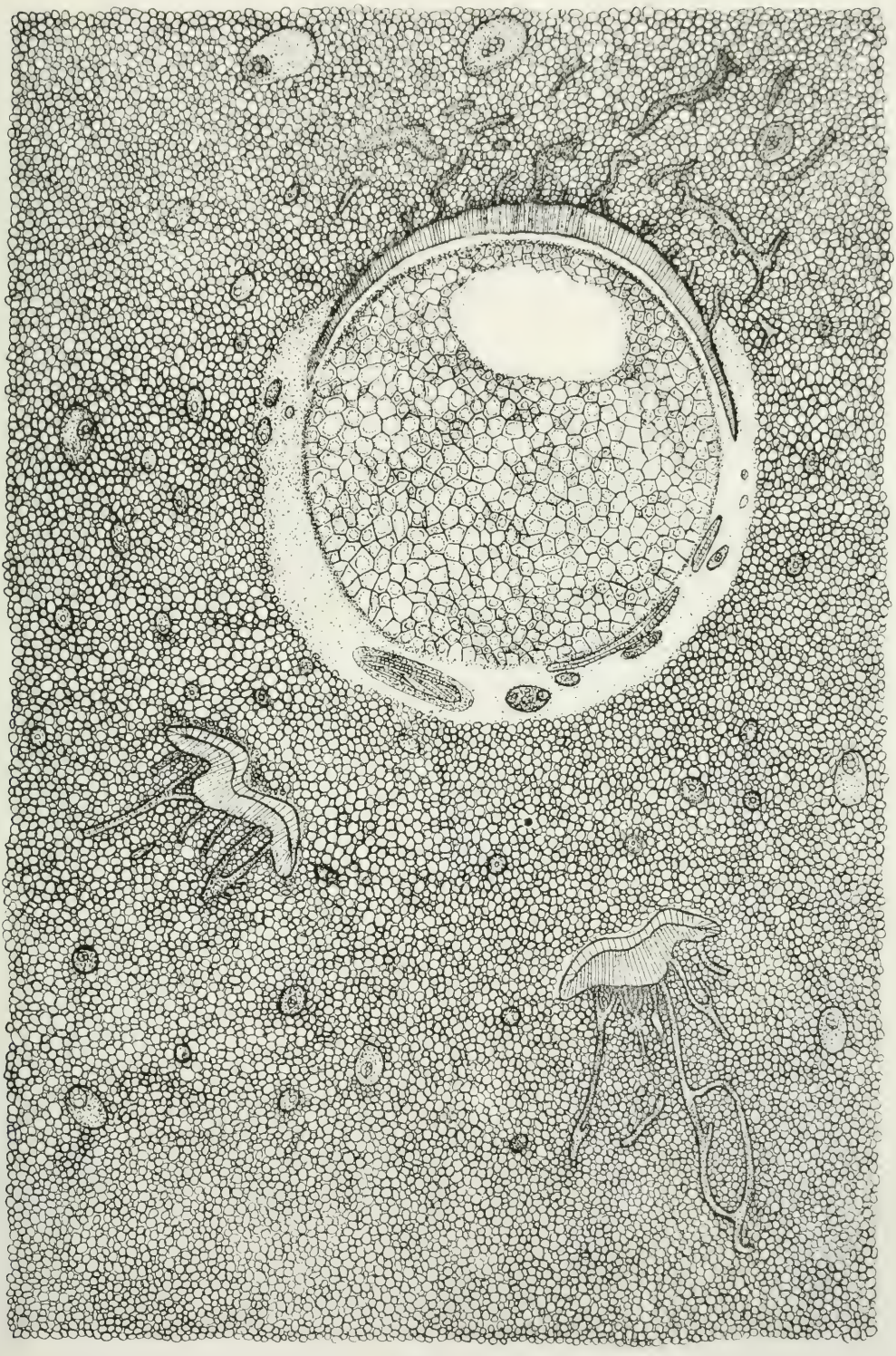

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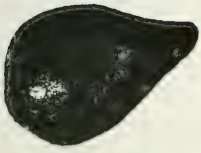

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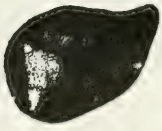

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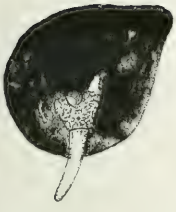

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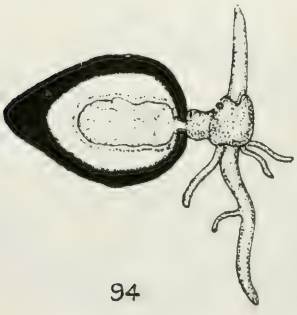

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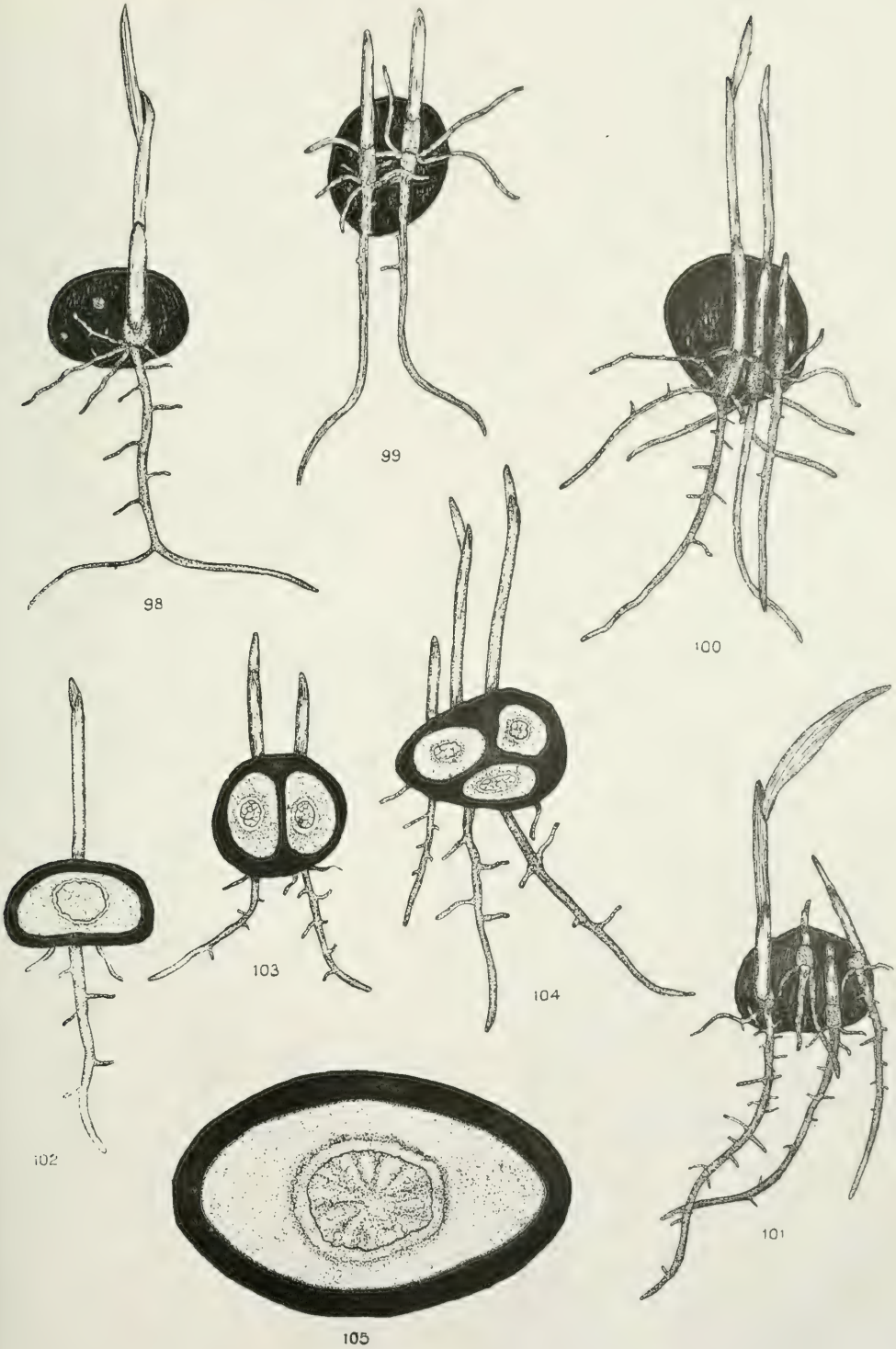
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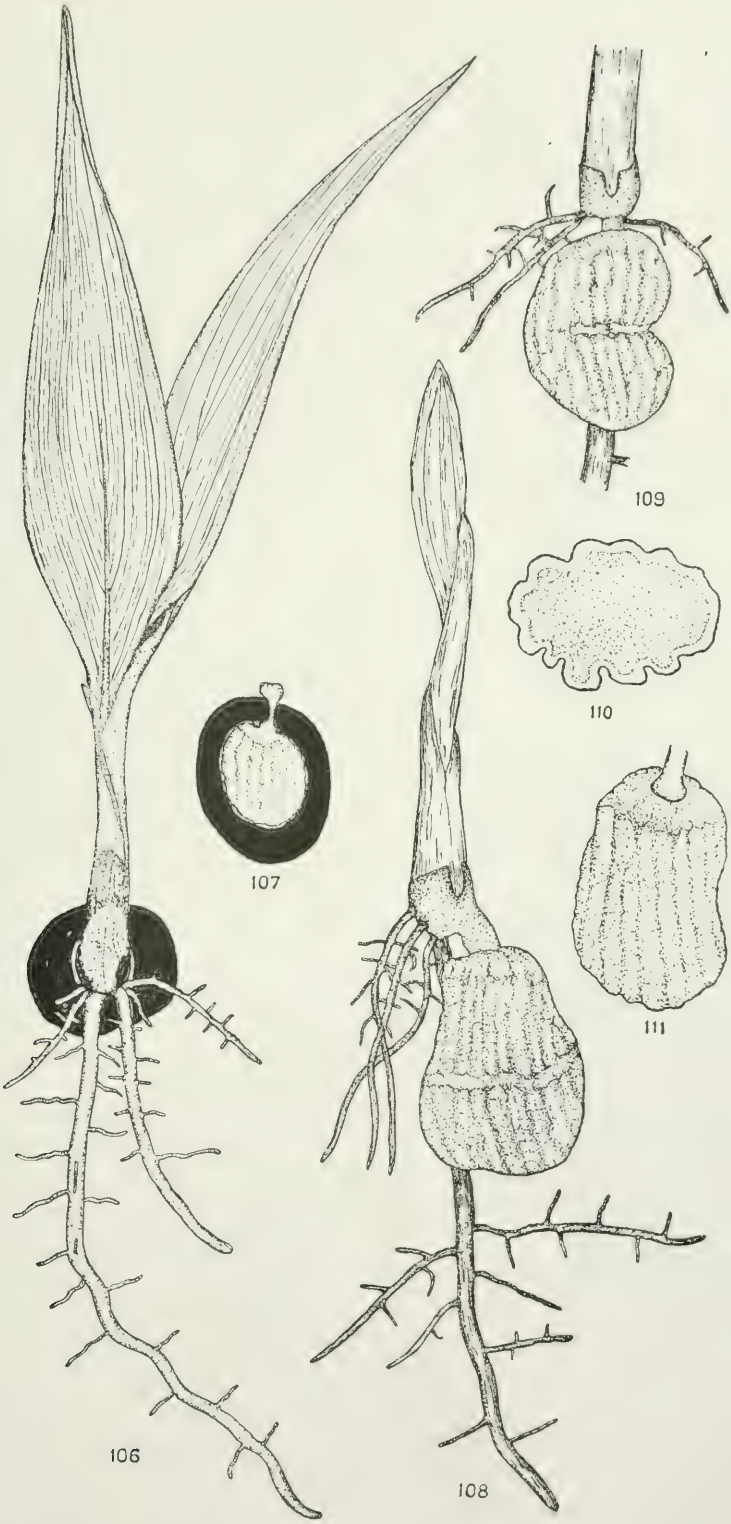
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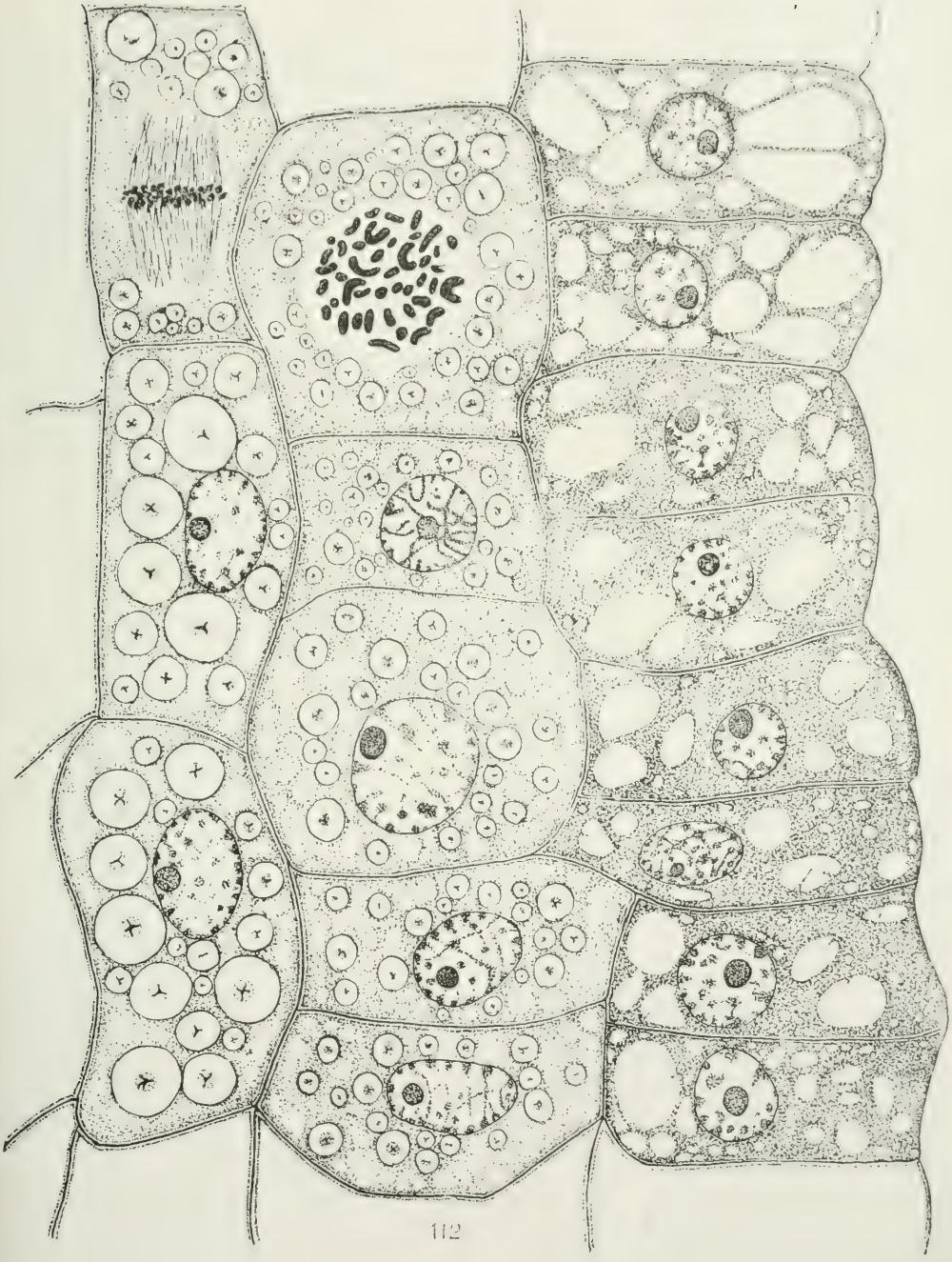

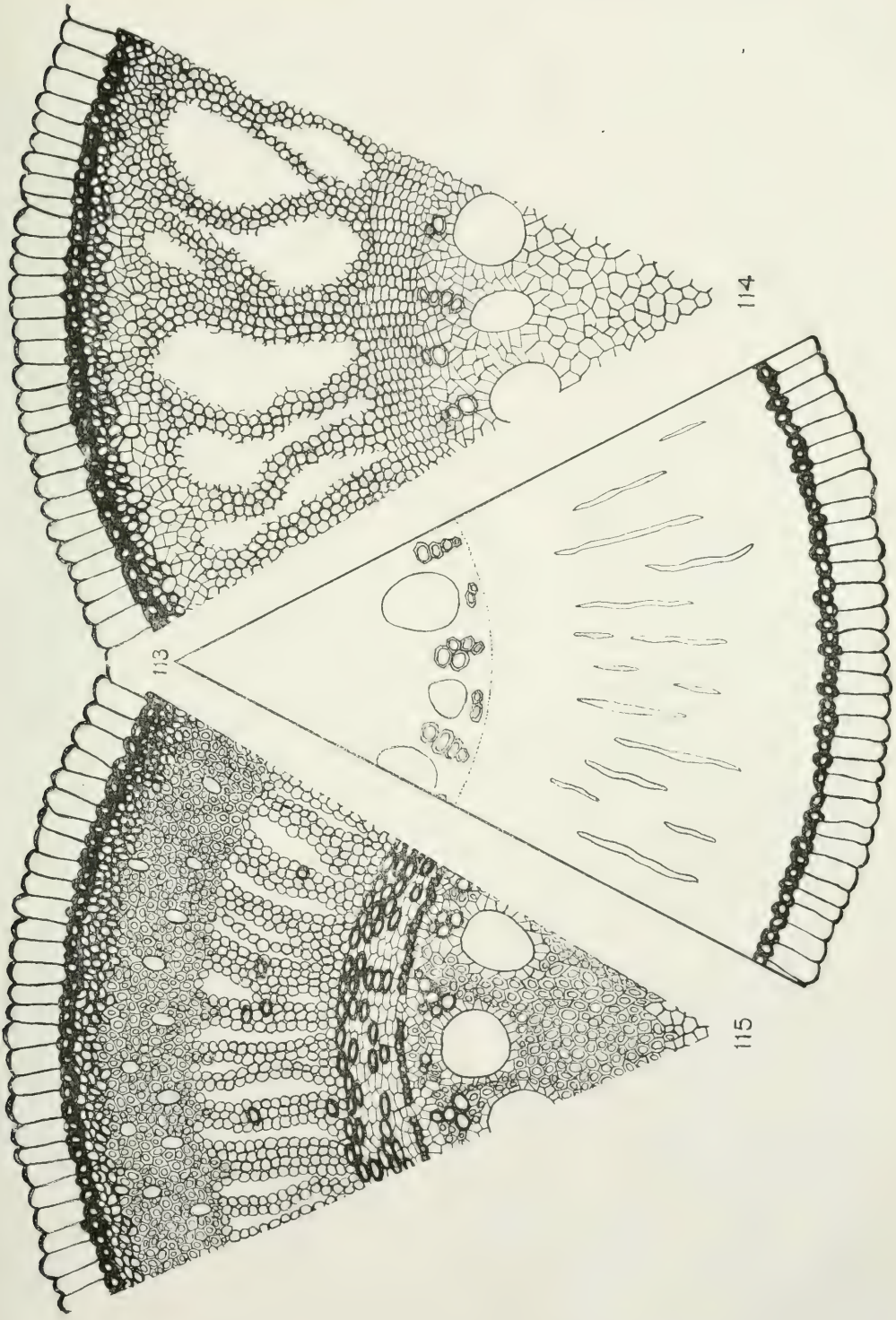
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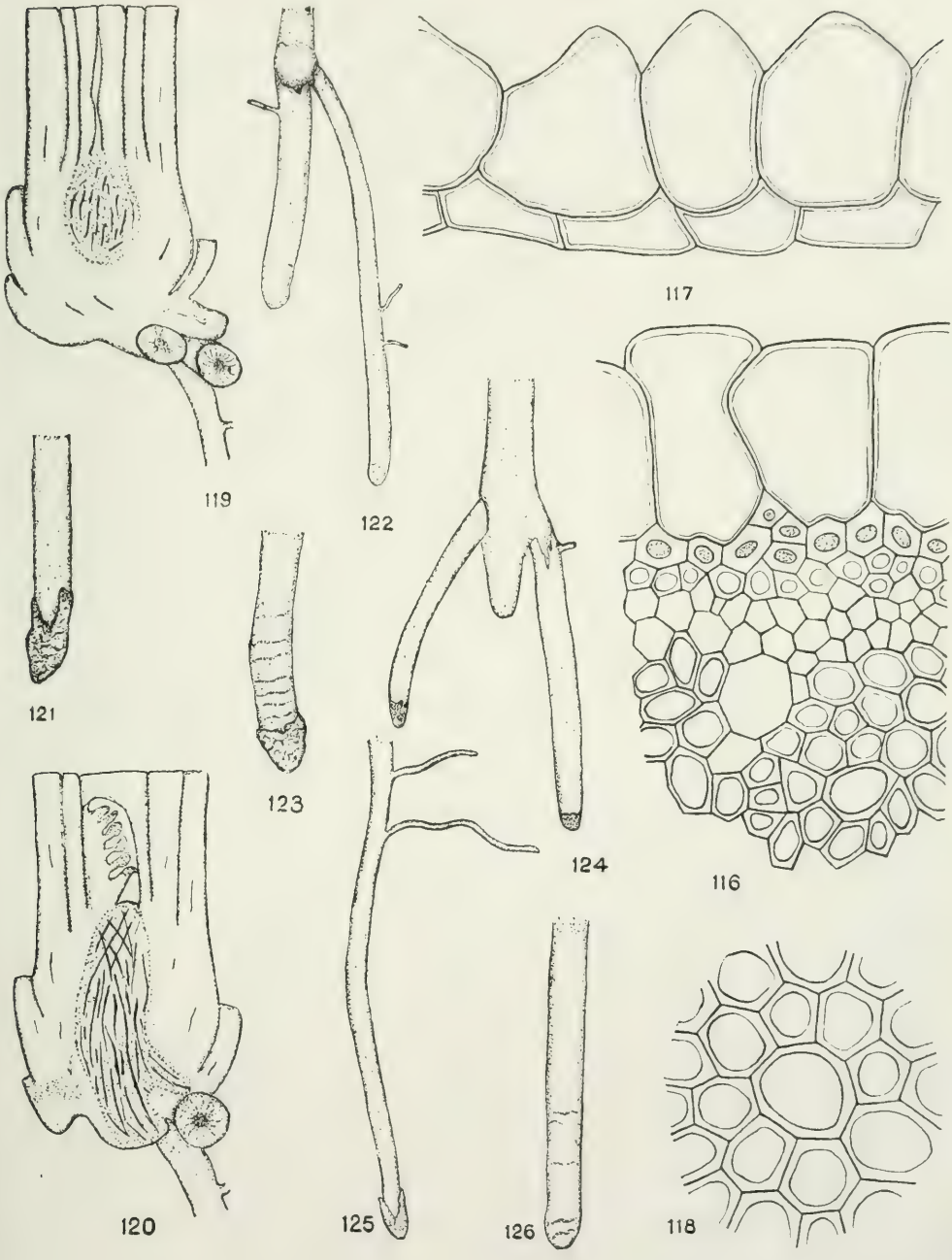
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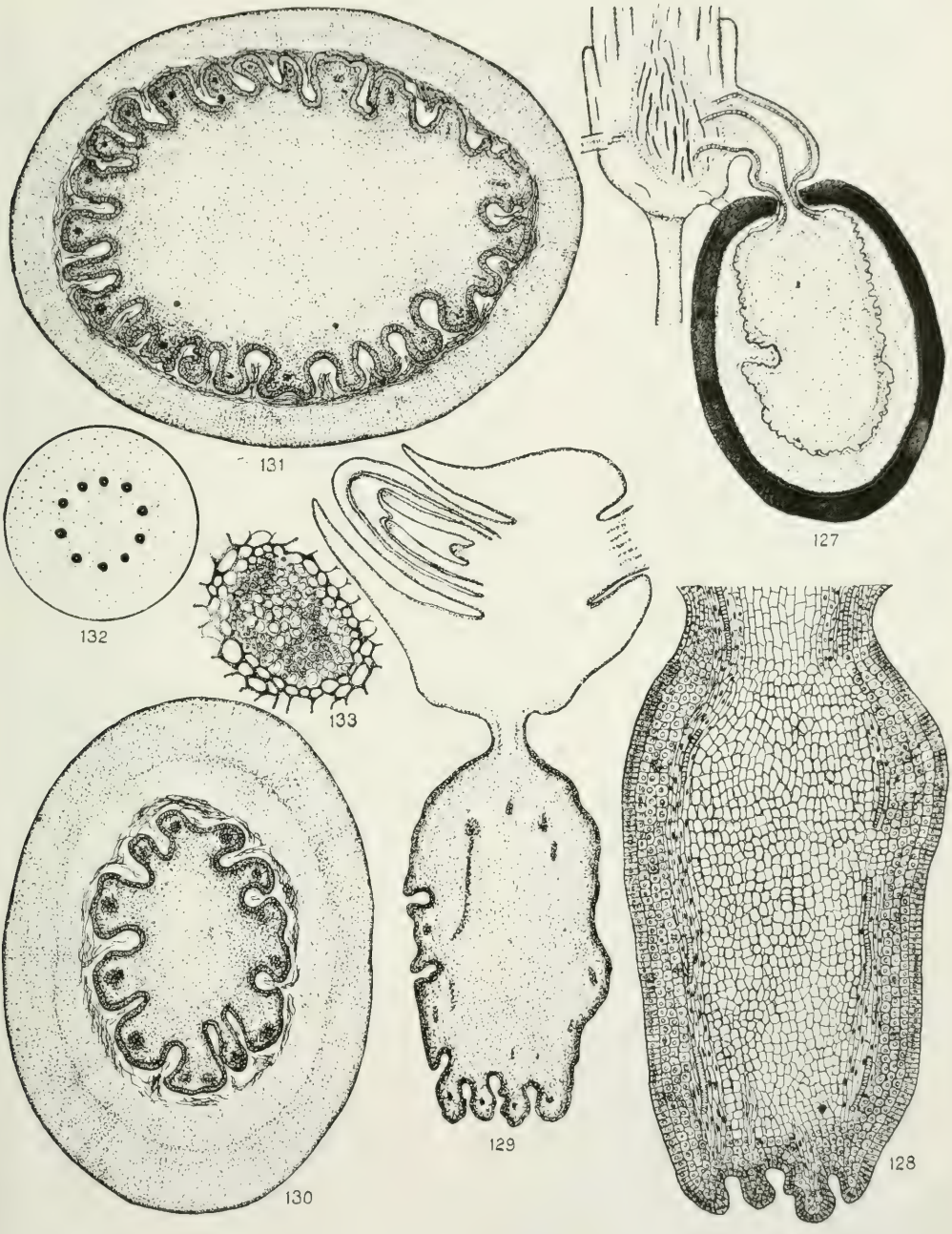
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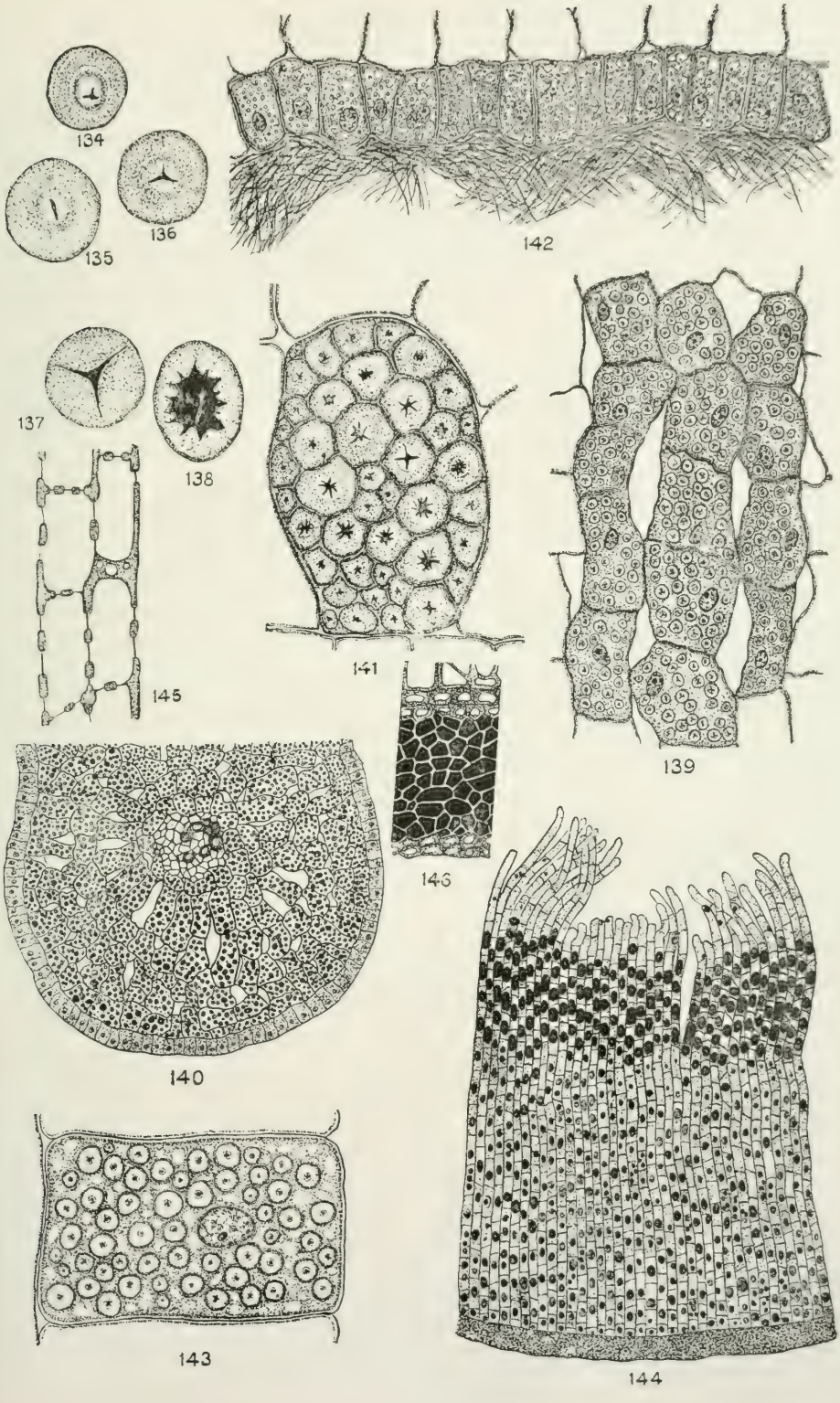
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NOTIZ UEBER VITEX

von

Dr. H. J. LAM.

Im Anschluss an die neuerdings von mir in dieser Zeitschrift veröffentlichte Revision von *Vitex* [1]) geben mir einige neue Funde und Bemerkungen Veranlassung zu nachstehenden Verbesserungen und Erläuterungen: In einer brieflichen Mitteilung lenkte Herr Prof. E. D. MERRILL, Manila, meine Aufmerksamkeit auf folgende Tatsachen:

1. **Vitex luzonica** H. J. L., l.c. p. 62. Dem in unserer Mitteilung zu dieser Art gezählten Specimen ist irrtümlicherweise eine fehlerhafte Nummer beigegeben: Statt 760 soll es 706 heissen.

2. **Vitex Merrillii** H. J. L., l.c. p. 64. — Diese Art, die ich zu den ungenügend bekannten Arten stellte und deren Namen ich änderte, weil sich nur ein MS-Name (*V. euphlebia* MERR.) auf der Etikette vorfand, ist, nach der Meinung von Prof. MERRILL, identisch mit *V. longifolia* MERR. Er fügt noch hinzu, dass die Pflanze wahrscheinlich selbst gar keine *Vitex* ist, sondern ein *Teysmanniodendron* und zwar vielleicht *T. bogoriense* KDS. Dies soll noch näher untersucht werden.

3. **Vitex hawaiiensis** H. J. L., l.c. p. 59. — Diese *Vitex*, die auf den Sandwich-Inseln eingeführt zu sein scheint, ist möglicherweise identisch mit einer amerikanischen Art. Unter meinen Notizen fand ich eine, in der vermutet worden ist, dass sie vielleicht zu der mexicanischen *Vitex mollis* KUNTH gehört. Diese Frage konnte aber nicht entschieden werden, weil ich hier kein Material dieser Art zur Verfügung habe.

Weiter meint Prof. MERRILL, dass folgende Synonyma zu beachten sind:

4. **Vitex Curranii** H. J. L., l.c. p. 61 soll identisch sein mit *V. aherniana* MERR..

5. **Vitex glandulosa** H. J. L., l.c. p. 58 mit *V. littoralis* DECNE. (*V. parviflora* JUSS.) und

6. **Vitex nitida** MERR., l.c. p. 56 mit *V. glabrata* R. BR. Leider aber konnten auch diese Fragen von mir nicht entschieden werden. Ich teile sie nur mit, um die Aufmerksamkeit der Forscher darauf zu lenken.

[1]) Bull. Jard. Botan. Btz. III (1921) p.1.

Dies die Bemerkungen, zu denen Prof. MERRILL's Mitteilungen Veranlassung gaben. Weiter kann ich auf Grund von neuen Untersuchungen im Buitenzorger Herbar Folgendes bemerken:

7. **Vitex vestita** WALL. ex SCHAU. in DC. Prodr. XI (1847) 692; LAM, l.c. p. 60. und Synon. ebendort.

Var. *α* **genuina** H. J. L., nov. var. — Calyx subregularis, minute 5-denticulatus, labio inferiore bidentato, superiore integro vel minutissime 3-dentato. Ausser den an der angegebenen Stelle (p. 60) genannten Exemplaren, gibt es im Buitenzorger Herbar noch folgende:

Brit. Nord-Borneo: Berg Kalawat (M. S. CLEMENS 11172!); Kota balut nach Kibajo (id. 9813!).

Java: (HORSFIELD!).

Sumatra: Labu alang, S. W. K. (TEYSMANN 1165!); Labu sikaping (id. 1158!); Muara Enim (id. 3671!).

Malaiische Halbinsel: Johor, Sungai Pulai dua (Md. Mutkiah 7742!)

Var. *β* **neglecta** H. J. L., nov. var. — *Vitex neglecta* H. J. L., l.c. p. 63. — Calyx distincte bilabiatus, labio inferiore bidentato, superiore plus minus elongato, 0.1—0.2 cM. longo.

Forma **puberula** — *V. neglecta* H. J. L., var. *α puberula* H. J. L., l.c.

Sumatra: [AJOEB (Exp. JACOBSON) 182! (l.c.)].

Sumatra: Palembang, bei Lematang ilir, ungefähr 50 M. ü. d. M. auf trockenem Land sehr allgemein (ENDERT n. E. 813!; blühend am 24. Januar 1920. Baumstrauch, 8 M. hoch, Stamm 10 cM. Durchmesser; Blütenknospe gelblich grün; Blütenkrone gelb, Blütenkelch gelblich grün; Antheren und Griffel weisslich; Thecae hell braun, Narbe hell grün; Fruchtknoten gelb, das untere Ende orange; Blüte schwach duftend; einh. Namen: kaju berebah).

Forma **glabrior** — *V. neglecta* H. J. L., var. *β glabrior* H. J. L., l.c.

Sumatra: [JACOBSON 2675! (l.c.)]; nördlich von Talu, 900 M. ü. d. M. (BÜNNEMEIJER 103!; Blüten gelb).

8. **Vitex Sebesiae** H. J. L., nov. spec. — Arbor, circiter 10 M. alta; ramuli crassi, quadrangulares, costis obtusiusculis, minute longitudinaliterque striati, epilosi sed dense minute flavo-glandulosi, praesertim in nodis; folia opposita petiolata, 5-(interdum 6-) foliolata; foliola petiolulata, chartacea, obovata vel oblongo-obovata, apice abrupte acuminata, acumine obtuso, basi saepissime inaequalia breviter decurrentia; supra nitida, in sicco griseo-fulva, plurimis areolis minutis (glandulis, secreto amisso); subtus in sicco fusca, ut supra plurimis glandulis minutis (nonnulli secreto flavo suffultis, nonnulli secreto amisso), tota minute sparseque pilosa; costa media supra vix prominens, ut nervi laterales pilis brevibus crispis suffulta; nervi laterales 9—11, sub angulo circiter 45° de costa adscendentes, marginem versus pauce arcuati, multis nervulis tertiariis (inter sese parallelibus, regularibus rectiusculis) inter sese conjuncti, prope marginem in nervaturam reticuliformem defluentes;

subtus costa, nervi laterales, nervuli tertiarii sparsiuscule pilosa; foliola terminalia 18 cM. longa, 8.9—10.2 cM. lata, petiolulo 3.1—4.2 cM. longo; lateralia 14—18$^1/_2$ cM. longa, 6.8—10 cM. lata, petiolulo 1.1—2 cM. longo; basalia 6.2—14 cM. longa, 3.7—2 cM. lata, petiolulo 0.4—0.8 cM. longo; petiolus communis 10—12.7 cM. longus, diametro 0.15—0.2 cM , ut petioluli flavo-glandulosus, minute pulverulentus; inflorescentia terminalis, e nonnullis inflorescentiis thyrsiformibus, densis, denique interruptis, composita; cymae parvae, binae binis oppositae, decussatae, bis usque ad quinquies dichotomae, 4—32-florae, bracteis caducis; inflorescentia thyrsiformis 12—13 cM. longa, 2$^1/_2$—5 cM. lata; cymae 0.9—2.5 cM. longae, 0.9—3 cM. latae, pedunculo 0.2—0.6 cM, longo, ut pedicelli pulverulento; pedicelli 0 2 cM longi, bracteola minuta (0.125 cM. longa) cito caduca lineare suffulti; calyx urceolaris, margine 5 dentibus regularibus minutis basi glandulo suffultis ornatus, intus glaber, extus pulverulentus, 0.3 cM. longus; corolla tubo curvato, parte inferiore recta, 0.35 cM. longa, apicem versus dilatato-curvata, toto 0.8 cM. longo; lobi labii superioris 2 obtuse deltoidei 0.2 cM. longi; lobi laterales 2 labii inferioris obtuse deltoidei, 0.3 cM longi, lobo centrale (labello) 0.5 cM. longo, 0.6 cM. lato, margine irregulariter sinuato, basi supra barbato; alabastrum dense pulverulentum et glandulosum praeter tubi partem inferiorem; lobi tubique pars superior extus dense pulverulenti et glandulosi, margine labelli excepto, intus glabri, basi labelli barbata excepta; stamina subdidynamia, tubi inserta regione, ubi extus pilorum confinium, 0.4 cM. exserta, glabra, antheris 0.1 cM. longis, thecis adultis semilunariter divergentibus, interdum alia aliis continuata; stylus glaber 0.6 cM. exsertus, apice bifidus, jugi ramuli 0.05 cM. longi; ovarium glabrum vel nonnullis glandulis vestitum, conicum; fructus glaber, globosus, 0.7 cM. diametro, parte inferiore calyce inclusa.

Insel Sebesi (Sunda-strasse zwischen Java u. Sumatra) am Rande des Urwaldes, 100 M. ü. d. M. (DOCTERS VAN LEEUWEN-REYNVAAN 5355! blühend am 28. April 1921; Blüten violett).

Die Pflanze ist nahe verwandt mit *Vitex heterophylla* ROXB., zumal mit der Varietät *genuina* H. J. L. (l c. 55) aus Burma, die neuerdings auch in Süd-Sumatra (Lampongs) nachgewiesen worden is, unterscheidet sich aber von dieser Art durch die gröberen, breiteren, obovaten Blätter, die viel längeren Blattstielchen und Blattstiele und die violette Blütenkrone. Die Blätter der letztgenannten Art sind immer (in den wenigen zur Verfügung stehenden Exemplaren) schmal-länglich.

9. **Vitex celebica** KDS., Med. 's Lands Pl.-tuin Btz. XIX (1898) 560 and 645; LAM, l.c. 56.

Halmaheira: Im Walde, 60 M. ü. d. M. (BEGUIN 2019!; "mamali" der Eingeborenen; Stamm 14 M. hoch, Krone 14 M. hoch, Umfang des Stammes in 1 M. Höhe ueber dem Boden, 3.10 M.; Rinde grau; Fuss des Stammes tief gefurcht; dieser Baum ist fast ausgerottet).

10. **Vitex cofassus** RW. ex BL. Bijdr. (1826) 813; LAM, l.c. 51.

Var. *α* **typica** H. J. L., l.c.

Buton: Kulipapo, Wila (BEVERSLUIS 2!; einh. N.: katonding); Sampolawa, im Walde, 25 M. ü. d. M. (DE BOER 16! [Boschproefstation (Versuchsanstalt für Forstwesen) bb. 2239]; einh. N.: wola [but.] oder katondeng [bugin.]; Baum, 35 M. hoch, 1 M. in Diam., Stamm oft gefurcht).

Buru: Tifu, 2 M. ü. d. M. auf Kalkfelsen (TOXOPEUS 52! Baum 6 M. hoch, Blüten bläulich violet); viele Blätter dieses Exemplares sind 2—3-zählig, bisweilen sind die Blättchen mehr oder weniger verwachsen.

Kei: (JENSEN 283!).

Var. *β* **puberula** H. J. L., l.c.

Neu-Irland: Lamekot (PEEKEL 10! Baum 20—30 M. hoch, im Walde; Juli 1920; einh. N.: fasé).

11. **Vitex trifolia** L., Spec. Pl. II (1753) 638; LAM l.c. 52.

Var. *α* **trifoliolata** SCHAU.

Buru: Leksula, 300 M. ü. d. M., auf Korallenkalk; (TOXOPEUS 631!; Baum, 10 M. hoch).

12. **Vitex pubescens** VAHL., Symb., bot. III (1794) 85; LAM, l.c. 53.

Sumatra: P. Tebing Tinggi, an der Küste (BRUINIER 87! einh. N.: leban); P. Rangsang (id. 8!); P. Selat Pandjang (id. 210!); P. Merbau (id. 227!).

Simalur: am Meeresstrand (ACHMAD 1605!; Baum, 11 M. hoch, Krone 6 M; Blüten hellgelb; einh. N.: manil alas).

Sulu-Archipel: Insel Tawi-tawi (YATES 36299!).

Borneo, Brit. N.-: Sandakan, Prov. Myburgh (ELMER 20101!).

13. **Vitex heterophylla** ROXB., Fl. Ind. III (1832) 75; LAM, l.c. 55.

Var. *β*. **undulata** CLARKE.

Borneo: Lio Matu, 170 M. ü. d. M. (MOUTON 6718!)

14. **Vitex Negundo** L., Sp. Pl. (1753) 638; LAM, l.c. 55.

Var. *β* **bicolor** H. J. L., l.c.

Neu-Guinea: Manokwari (JANOWSKY 518!).

Schouten-Inseln: Biak, Nordküste (FEUILLETAU DE BRUYN 414!).

15. **Vitex siamica** WILLIAMS, Bull. Herb. Boiss, Sér. II, V (1905) 431; LAM, l.c. 58.

Malaiische Halbinsel: Kedah, Telok Apau (Md. Hariff 7079!; ? einh. N.: lankawi; Baum, 15 – 20 Fuss hoch).

16. **Vitex flabelliflora** HALL. F., Med. 's Rijks Herb. Leid. no. 37 (1918) 50; LAM, l.c. 58.

Borneo, S.-O.-: Ma. Nusa, Kahajan (M. Semeroe 17! [Boschproefstation (Vers. anst. f. Forstw.) bb. 2105]; einh. N.: gragai; vor allem auf nassem Grund und längs Flüssen; kleiner Baum, Blüten violet-weiss, angenehm duftend; Holz wertlos).

DEPARTEMENT VAN LANDBOUW, NIJVERHEID EN HANDEL

„'S LANDS PLANTENTUIN"

(„JARDIN BOTANIQUE DE BUITENZORG")

Bulletin du Jardin Botanique

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NEW OR INTERESTING MALAYAN FERNS 12.

by

CAPT. C. R. W. K. VAN ALDERWERELT VAN ROSENBURGH.

Wherever the contrary has not been mentioned the following diagnoses were made after dried material and the descriptions of the colours were taken from the field notes of the collectors.

Regarding the synonyms referring to CHRISTENSEN's Index Filicum I note that the ferns of the Buitenzorg Herbarium are now arranged in accordance with my conception.

Isospore Filicales.

Adiantum rhizophorum SW. Syn. 320, 422; v. A. v. R. Mal Ferns 324.

Rhachis naked or nearly so, not copiously hairy (as is shown in HK., Spec. Fil., II, tab. LXXX A), and the indusium transversely oblong, with a tendency to become obreniform.

A plant from Java (Besoeki, Mt. Kendeng, C. A. BACKER No. 30737), which is seemingly a form of this, has the central leaflets horizontal, somewhat decurved, less deeply lobed, the lower leaflets deflexed, and the veins not compact.

Adiantum suborbiculare v. A. v. R. Bull. Dép. Agr. I. N. XVIII (1908), 11; Mal. Ferns 31; Supplem. I, 238.

Also in the Riouw Archipelago: Poeloe Bintan, Mt. Bintan, on stones in forest, alt. 250 m. (H. A. B. BÜNNEMEIJER No. 6167, 14 June 1919).

Adiantum flabellulatum L. Spec. II, 1095; v. A v. R. Mal. Ferns 334.— *A. Doctersii* v. A. v. R. Bull. Btz. XI (1913), 1, tab. I; Supplem. I, 236.

Forma **typicum**: Fronds flabellate-pedate, subdichotomous.

Forma **Doctersii**: Fronds pinnately branched. — United with the type by intermediates.

Alsophila Janseniana v. A. v. R.

Truncus usque 50 cm. vel plus altus. Stipites ± 160 cm. longi, inermes, praesertim in juventute dense squamosi, parte inferiore fusci, parte superiore (cum rhachide) pallidiores; squamae relative longae, lineari-lanceolatae, flavido-brunneae, nitentes, graciliter longe acuminatae, setulis spinuliformibus, brevissimis, rubido-brunneis, acutis, dense ciliolatae, basibus persistentibus, subverruculiformibus. Frondes lineari-lanceolatae, ± 230 cm. longae, abrupte

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breviter acuminatae, pinnatae; rhachis laevis, glabrescens, in juventute supra pilis erectis, flavido-brunneis hirsutula; pili probabiliter squamulis filiformibus intermixti. Pinnae plus minusve coriaceae, glabrae; pinna terminalis e basi subtruncata elongato-deltoidea, infra apicem acute acuminatum, serrulatum lobata, basi profunde pinnatipartita, lobis maximis lineari-oblongis, obtusis, integerrimis vel serratis; pinnae laterales remotae, cum rhachide articulatae, ascendentes vel superiores magis patentes; pinnae superiores parvae, sessiles, lineari-oblongae, plus minusve profunde lobatae, in lobos inferiores pinnae terminalis transientes; pinnae sequentes lineari-lanceolatae; pinnae inferiores maximae, brevissime petiolulatae, subsessiles, ± 36 cm. longae, supra basin 6 cm. latae, parte superiore infra apicem sensim acute acuminatum et serrulatum lobatae, parte mediana profunde pinnatipartitae, basi pinnatae; costa supra hirsutula, subtus glabra (glabrescens?). Segmenta usque 40 utrinque; segmenta superiora medianaque conferta vel subimbricata, suboblonga ad oblonga; segmenta inferiora conferta, approximata vel paullo remota: segmenta inframediana vel suprabasalia maxima, lineari-oblonga, 2—3 cm. longa, $^3/_4$—1 cm. lata, obtusa vel obtusiuscula, integerrima, basi superiore rotundata, basi inferiore abrupte dilatata et angustissime decurrentia; segmenta inferiora plus minusve abbreviata, infima libera, sessilia, basi utrinque rotundata; costula subtus squamulis paucis, minutissimis, lanceolatis, brunnescentibus, spinoso-acuminatis, parce spinuloso-ciliolatis munita; venae distinctae sed graciles, ascendentes, plerumque irregulariter ramosae (furcatae vel duplicato-furcatae, vel parce pinnatae ramis simplicibus vel furcatis), hic illic simplices. Sori in pinnis superioribus inter costulam marginemque mediani, in pinnis inferioribus ad venas inframediani, costulam approximati, postremo subconfluentes et costulam plus minusve obtegentes; sori inferiores (praesertim inferiores postici) plus minusve a costula remoti; capsulae paraphysibus gracilibus, piliformibus, pallidis intermixtae.

Besides the normal segments and alternate with these there are not rarely much abbreviated to conspicuously elongated ones varying from short-oblong (7 mm. long, 5 mm. broad) to short-linear (5 cm. long, $1^1/_4$ cm. broad, acute, crenate). Subcostular row of sori sometimes accompanied by a few sori placed outside near the normal ones.

This species bears the name of Mr. P. J. JANSEN T. PZN., General Manager of Simau, who has always taken much interest in BROOKS' collections.

Sumatra: Benkoelen, Lebong Tandai, in shady jungle on hill side (C. J. BROOKS, July 1921).

Alsophila allocota v. A. v. R.

Stipites ± $17^1/_2$ — 20 cm. longi, supra 3-sulcati, pallide brunnei, ceterum purpureo-brunnei (vel castanei), glabrescentes, basibus persistentibus, copiosis, tuberculiformibus, castaneis squamarum deciduarum asperi; squamae scarioso-subcoriaceae, flavido-brunneae vel ochraceae, saepe brunneo-marginatae,

inferiores densae, ceterae copiosae, infimae longissimae angustissimaeque, lineari-subulatae, ceterae pro ratione multo latiores, lineari-triangulares, falcatae, superiores deciduae, sensim minores, omnes nitidae, pilis brevissimis, rubro-brunneis vel castaneis, acutis, spinuliformibus ciliolatae, apice graciliter longe acuminatae Frondes lanceolato-oblongae, ± 75 cm. longae, 45 cm. latae, utrinque angustatae, apice acuminatae; rhachis apicem versus anguste alata, supra pilis pro portione longis, curvatis vel erectis, subflexuosis, ferrugineis vel ochraceis hirsuta, ceterum partem superiorem stipitis simulans sed basibus persistentibus squamarum deciduarum multo numerosis, minoribus, saepe subpunctiformibus, flavido-brunneis vel ochraceis. Pinnae multae, confertae, superiores ascendentes, sequentes patentes, inferiores deflexae; pinnae medianae maximae, petiolatae, e basi paullo angustata ovato-lanceolatae, ± 25 cm. longae, $7^1/_2$ cm. latae, acuminatae; pinnae inferiores lanceolato-oblongae, ± $12^1/_2$ cm. longae, medio ± $4^1/_2$ cm. latae; rhachis apicem versus anguste alata, supra hirsuta, subtus squamulosa; squamulae pallidae, brunneo-spinuloso ciliatae, inferiores partim lineari-subulatae, partim e basi bullata ovato-subulatae, superiores iis costarum similes. Pinnulae papyraceae, glabrae, contiguae vel leviter imbricatae, patentes vel subhorizontales, lineari-oblongae, superiores basi late cuneata vel subtruncata adnatae et ala rhachidis connatae, sequentes breviter petiolulatae, cum rhachide articulatae; pinnulae suprabasales maximae, ± 4 cm. longae, $1^1/_2$ cm. latae, marginibus subparallelis, parte inferiore ± $^1/_2$ costam versus incisae, apicem obtusum, parce rotundato-crenatum versus minus profunde lobatae; costa supra parce hirsuta, subtus squamulis ovatis, bullatis, pallidis longe acuminatis, ciliolatis munita. Lobi contigui vel subcontigui, oblongi, ± 4 mm. lati, integerrimi, apice obtusi vel rotundati; venae utrinque latere costulae 4—6, simplices vel furcatae, interdum hic illic anastomosantes. Sori ad venas 1—3 inferiores mediani; capsulae pro ratione paucae, pilis articulatis, alternatim pallide et obscure castaneo-annulatis, quam capsulis paullo longioribus intermixtae.

The wing uniting the higher, undivided or slightly incised pinnae or pinnulae is broadest medial between the pinnae or pinnulae, becoming gradually narrower towards the place of union with the pinnae or pinnulae.

The texture, when seen towards the light (under the lens), is provided with very numerous roundish, oblong or linear, simple or branched, free or confluent groups of darker-coloured cells resembling spurious veins subparallel with the real veins. The sori are placed on laterally compressed increasing of the veins.

Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 1000 m. (H. A. B. BÜNNEMEIJER No. 5936, 21 May 1919).

Alsophila glabrescens V. A. V. R.

A. glabrae HK. affinis. — Stipites castanei, squamis subulatis, fuscis, saepe anguste, obscure marginatis, dense, breviter castaneo-spinuloso-cilio-

latis, inferioribus sat persistentibus, subdensis, ceteris deciduis ornati, postremo basibus persistentibus squamarum decessarum copiose tuberculato-asperi. Rhachis primaria castanea, supra brevissime, decidue castaneo-fibrilloso-puberula, postremo basibus persistentibus pilorum decessorum dense puncticulato-asperula, subtus in juventute probabiliter furfuracea vel squamulosa, mox glabrescens et copiose verruculoso- vel punctato-asperula; rhachides secundariae rhachidem primariam simulantes sed laeves. Pinnulae coriaceae, maximae ± 6 cm. longae, 1 cm. latae, infra apicem obtusiusculum vel subobtuse acuminatum crenatumque $^1/_2$—$^2/_3$ costam versus incisae, lobis oblique oblongis, integerrimis, apice obtusis vel rotundatis; venae simplices.

Lingga Archipelago: Poeloe Singkep, Mt. Landjoet, in forest, alt. 40 m. (H. A. B. BÜNNEMEIJER No. 7286, 5 October 1919).

Alsophila spinifera v. A. v. R.

Truncus usque ± 1 m. altus. Stipites ± 75 cm. longi, spinosi, cum rhachide decidue ferrugineo-furfuracei; spinae squarrosae, inferiores copiosae, longe conicae, acutae, superiores sensim in spinulas rhachidis transientes. Frondes ± 140 cm. longae, acuminatae, 3-pinnatipartitae; rhachis aculeata, spinulis superioribus sparsis, brevissimis, acute conicis. Pinnae subhorizontales, medianae inferioresque petiolatae; pinnae medianae maximae, lanceolato-ovatae, ± 55 cm. longae, $17^1/_2$ cm. latae, acuminatae; rhachis supra dense lanuginoso-villosa, pilis crispatis, ferrugineis, squamulis deciduis, sparsis, breviter et anguste lineari-subulatis, subcrispatis, rufo-fuscis, erosis intermixtis, subtus ± decidue ferrugineo-furfuracea, gibbis minutissimis, sparsis, acute conicis asperula. Pinnulae subrigide coriaceae, glabrae, in sicco supra purpureo-brunneae, subtus pallide brunneae, numerosae, paullo remotae, sessiles vel subsessiles, inferiores brevissime petiolulatae; pinnulae inframedianae maximae, lineari-lanceolatae, usque $9^1/_2$ cm. longae et supra basin rotundato-truncatam $2^1/_2$ cm. latae, pinnatipartitae, apice sensim acuminatae et serratae; costa supra sublanuginoso-villosa, subtus copiose squamulosa, squamulis ovato-lanceolatis, piliformi-acuminatis, subcrispatis, brunneis, leviter erosis. Lobi numerosi, subconferti, subhorizontales, breviter lineares, subfalcati, usque 3 mm. lati, obtusi, crenato-serrati vel -dentati; costula supra glabra, subtus squamulosa, squamulis superioribus subbullato-ovatis, piliformi-acuminatis, brunneis, inferioribus iis costae similibus sed minoribus; venae usque 10—12 utrinque, furcatae vel duplicato-furcatae, superiores simplices. Sori costulares, ad venas 1—2 inferiores; capsulae squamulis pro portione longis, subcrispatis, angustissimis, subfibrilliformibus intermixtae.

Sumatra: Toba, Habinsaran Plateau, in primeval forest on slope of ravine, alt. 1225 m. (J. A. LÖRZING No. 6588, 11 May 1919).

Angiopteris lancifoliolata V. A. V. R.

Stipites certe basin versus parce tuberculati verruculosique et copiose squamulati, glabrescentes; squamae partim parvae, anguste subulatae, nigrae vel nigro-castaneae, graciliter longe acuminatae, partim minutissimae, furfuriformes, ferrugineae. Pinnae medianae vel inferiores maximae, usque ad + 90 cm longae; rhachis glabrescens, in sicco fusca. Pinnulae subcoriaceae, flaccidae, in sicco supra fuscae, subtus pallidiores; ad costam venasque parce ferrugineo-lanuginoso-squamulosae, glabrescentes elongato-lanceolatae, sessiles vel breviter (2 mm.) petiolulatae, basi aut aequaliter cuneatae vel late rotundato-cuneatae, aut antice abrupte cuneatae, postice rotundato-cuneatae, margine crenulatae vel repando-crenulatae, apice anguste cuspidato-acuminatae, acumine leviter, late crenulato, basi serrulato; pinnarum maximarum pinnulae medianae vel supramedianae maximae, + 16 cm. longae, ad vel infra $2^1/_2$ cm. latae; costa venaeque subtus in sicco fuscae, nigrescentes; venae approximatae, patentes, impellucidae; venulae recurrentes longae sed absconditae, impellucidae. Sori submarginales, contigui, basin acuminis attingentes; capsulae 9—15, plerumque 12, rotundatae, brunneae, postice applanatae, nigrae vel nigro-castaneae; indusium pilis ferrugineis, crispatis.

The lines of sori correspond with a longitudinal depression on the upper side of the pinnulae.

Lingga Archipelago: Poeloe Singkep, Mt. Landjoet, river side in forest, alt. 50 m. (H. A. B. BÜNNEMEIJER No. 7288, 5 August 1919).

Angiopteris athroocarpa V. A. V. R.

Rhachides secundariae in sicco fuscae, subtus teretes, supra 2-sulcatae, glabrae (glabrescentes?). Pinnulae crasse coriaceae, in sicco fusco-griseae ad fuscae; pinnulae medianae vel superiores maximae, elongato-lanceolatae, $17^1/_2$—20 cm. longae, 2—3 cm. latae, petiolo 1—3 mm. longo instructae, basi interdum aequilaterae, rotundatae vel truncato-cuneatae, plerumque inaequilaterae, oblique rotundato-truncatae, hinc inde subcordato-emarginatae, margine minute crenulatae ad serrulatae, hic illic subintegerrimae, apice sensim longe acuminatae, minute serrulatae; pinnulae inferiores plus minusve diminutae, interdum petiolo usque ad 1 cm. longo instructae; costa venaeque subtus glabrae (glabrescentes?); venae venulaeque recurrentes postremo fuscescentes ad nigrescentes, patentissimae, subhorizontales; venae impellucidae; venulae recurrentes longae costam attingentes, interdum pellucidae. Sori intramarginales, contigui; capsulae plerumque 12—16, interdum 8—10, fusci, rotundati; indusium pilis brevibus, rufis.

Near *A. javanica* PR. but broader, and the edges more finely crenulate or serrulate.

Sumatra: Mt. Koerintji, river side in forest, alt. 1800 m. (H. A. B. BÜNNEMEIJER No. 9644, 19 April 1920).

A. monstruosa V. A V. R. this Bull. II², 130.

Var. **pseudomacroglossum**: A forma typica differt foliolis magis coriaceis, soris capsulis magis numerosis, usque 20—30.

The type and the variety are perhaps hybrids of an *Angiopteris* and a *Macroglossum*, or intermediates between them.

Sumatra: Bengkoelen, Lebong Tandai (C. J. BROOKS, December 1921).

Antrophyum ovatum V. A. V. R. Bull. Dép. Agr. I. N. XVIII (1908) 17, tab. II, fig. 1 *a—e*; Mal. Ferns 534.

Stipes close, approximate or subremote, slightly scaly towards the base; scales like those of the rhizome.

A specimen from the Riouw Archipelago (Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 1000 m., H. A. B. BÜNNEMEIJER No. 5947, 21 May 1919) has the sori longer, reaching the central portion of the fronds, free or slightly anastomosing, with the paraphyses less strongly twisted.

Aspidium tricuspe BEDD. Handb. Ind. Ferns, Supplem., 44; V. A. V. R. Mal. Ferns 235.

Var. **glabrum**: Stipites non alati. Frondes segmentis angustioribus; segmenta lateralia maxime 4 cm. lata, basi postica interdum furcata; segmentum centrale maxime 5 cm. latum, basi interdum hastato-pinnatifidum; costae venaeque glabrae.

Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 400—500 m. (H. A. B. BÜNNEMEIJER Nos. 5834, 5948, 19—21 May 1919).

Aspidium ternatense V. A. V. R. Bull. Dép. Agr. I. N. XVIII (1908), 9; Mal. Ferns 238; Supplem. I, 191.

V. M. A. BEGUIN's No. 842 from Ternate (Akè Bobotja) has the barren fronds to 65 cm. long, with the pinnae to 35 cm. long, 7 cm. broad, the fertile fronds to 45 cm. long, with the pinnae to 21 cm. long, 3 cm. broad, and the sori more deeply immersed.

Asplenium cymbifolium CHRIST in Bull. Herb. BOISS. 2e Sér VI, 999; V. A. V. R. Mal. Ferns 440.

Veins mostly simple, sometimes forked.

Forma **typicum**.—Luzon.

Forma **lingganum**: Frondes minores, usque ± 60 cm. longae et 6 cm. latae. Sori breves, dimidium basalem venarum occupantes, costam non attingentes, venis venulisve sterilibus 2—10 interpositis.

Lingga Archipelago: Poeloe Singkep, Baroe, in forest, epiphytical, alt. 30 m. (H. A. B. BÜNNEMEIJER No. 7388, 8 August 1919).

○ **Aspienium pseudo-caudatum** v. A. v. R.

Euasplenium. Rhizoma erectum, squamis subulato-lanceolatis, fuscis. Stipites approximati, 25—35 cm. longi, cum rhachide in sicco fusci, glabri. Frondes lanceolatae vel triangulari-lanceolatae, 40—45 cm. longae, pinnatae, caudato-acuminatae. Pinnae firmiter herbaceae, glabrae, infra pinnam terminalem ± 20 utrinque; pinna terminalis elongato-triangularis, apice remote serrato-crenata, basi remote et profunde pinnatipartita, lobis obliquis, breviter linearibus, integerrimis vel apice 2-crenatis; pinnae laterales petiolatae vel superiores sessiles; pinnae superiores lanceolato-oblongae, acutae vel obtusiusculae, obtuse serrato-crenatae, basi oblique et anguste cuneatae, supremae in lobos basales pinnae terminalis transientes; pinnae inframedianae vel inferiores maximae, longiuscule (usque ad 1 cm. longe) petiolatae, elongato-triangulares, usque ad 10—12 cm longae, basi oblique cuneato-truncata $2^1/_2$—3 cm. latae, apicem remote serrato-dentatum, subcaudatum versus serrato-lobatae; pinnae inframedianae basin versus sensim profunde pinnatifidae; pinnae inferiores basin versus sensim profundissime pinnatipartitae, subpinnatae. Segmenta (crenae, dentes, lobi) obliqua; segmenta superiora (crenae, dentes) integerrima vel apice 2-crenata; segmenta sequentia (lobi) breviter linearia vel parallelogrammiformia, apice plerumque oblique truncata, plus minusve copiose crenata; pinnarum inferiorum segmenta inferiora sublibera (ala costali angustissima conjuncta), cuneato-flabellata vel -oblonga, usque ad 2 cm. longa et $1^1/_4$ cm. lata, margine exteriore obtusa vel rotundata, plus minusve irregulariter crenato-dentata; venae graciles sed distinctae, obliquae, superiores simplices, centrales 2—3-furcatae, inferiores plus minusve distincte flabellato-dichotomae; venulae ultimae in singulis dentibus (crenaturis serraturisve) solitariae, eorum apices haud attingentes. Sori valde obliqui, inter costam marginemque mediani, plerumque ramulos anticos venarum furcatarum occupantes; indusium latiusculum.

Central pinnae resembling much those *A. caudatum* FORST.; lower segments of lower pinnae resembling the pinnulae of *A. cuneatum* LAM.

Sumatra: Mt. Koerintji, in forest, alt. 1500 m. (H. A. B. BÜNNEMEIJER No. 8432, 4 March 1920).

Asplenium tenuifolium DON, Prod. Flor. Nep. 8; v. A. v. R. Mal. Ferns 469.

Rhizome short, the scales lanceolate-subulate, fuscous or black-brown, glossy or iridescent. Stipes aggregate, $7^1/_2$—20 cm. long, naked, dark-brown or blackish, or the upper part green, as is the naked rhachis. Fronds lanceolate-ovate, 15—30 (after BEDDOME to 50) cm. long, deeply 3-pinnatipartite, acuminate. Pinnae ± 15 on each side (after HOOKER and BAKER numerous), spreading or subhorizontal; higher pinnae adnate or sessile, short, linear or subspathulate-cuneate, entire or 2—3-fid; lower pinnae stalked, rhomboidal-oblong from a very obliquely truncate-cuneate base, blunt or bluntish; largest pinnae 5—$7^1/_2$ cm. long, ± 2 cm. broad. Pinnulae close

or approximate, ± spreading, the lower shortly rhomboidal-oblong, blunt, deeply pinnatipartite. Tertiary segments to 3 on each side below the terminal one; terminal segment cuneate-clavate or-obovate, more or less deeply 2—4-fid; lateral segments close or approximate, more or less ascending, the higher lanceolate to subspathulate, entire or more or less deeply 2-fid; lower segments cuneate-obovate from a narrowed or even linear-cuneate, substipitiform base, more or less deeply 3—4-fid. Ultimate segments shortly, acutely acuminate. Texture thin; surfaces naked; veins 1 to each ultimate segment, not reaching the apex, not rarely relatively very short. Sori proportionally short, at best 1 to each ultimate segment, ± parallel to the margin; indusium thin, broad.

Malacca; Brit. India.

Asplenium acutiusculum BL. Enum. Pl. Jav. II, 178; V. A. V. R. Mal. Ferns 463.

The authentic specimen of this species is unknown to me.—The plants occuring in the Buitenzorg Herbarium under the name of *A. acutiusculum* BL. have the pinnae varying from serrate-crenate to lobate-crenate with the crenations (teeth, lobules) entire or the central ones 2-crenate or 2-serrate and the lower not rarely more copiously serrate-crenate or dentate-crenate. — A plant from Java, gathered and determined by RACIBORSKI, has the lower pinnae subpinnate towards the base, with the segments resembling the pinnulae of *A. cuneatum* LAM.; the specimen, however, differs, distinctly from the next preceding.

Plants from Sumatra, gathered by BÜNNEMEIJER, are apparently intermediate between *A. acutiusculum* BL. and *A. caudatum* FORST.; some of the specimens are approaching the former, and others approaching the latter.

Asplenium scandens J. SM. in Journ. of Bot. III, 408; V. A. V. R. Mal. Ferns 475.

Also in Ternate: Moja, in ravine in deep shade, alt. 300 m. (V. M. A. BEGUIN No. 1013, 22 October 1920).

Blechnum Finlaysonianum WALL. List No. 2172; V. A. V. R. Mal. Ferns 387.

Also in the Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 700 m. (H. A. B. BÜNNEMEIJER No. 5837, 19 May 1919) and in the Lingga Islands: Poeloe Singkep, Dabo, in forest, alt. 40 m. (H. A. B. BÜNNEMEIJER No. 7270, 4 August 1919).

Blechnum orientale L. Spec. II², 1535; V. A. V. R. Mal. Ferns 387.

A specimen from Sumatra (Deli, Bandar-baroe, in secundary forest, alt. 800 m., J. A. LÖRZING No. 6392) is distinguished in having the fronds very large, to $4^1/_2$ m. long (including the stipe?), the pinnae to 40 cm. long, $2^1/_2$ cm. broad.

Cyathea Bünnemeijeri V. A. v. R.

Stipites ± 50 cm. longi, in juventute pallide ferrugineo-furfuracei, glabrescentes, in sicco fusci vel pallide fusci, parte inferiore copiose, breviter, acute spinulosi, squamosi, parte superiore tuberculis minutissimis (spinulis reductis), conicis, sparsis asperuli; squamae sparsae vel inferiores approximatae, anguste lineari-subulatae, fuscae, graciliter acuminatae, integerrimae vel basin versus erosodenticulatae. Frondes ovato-oblongae, 75—100 cm. longae, acuminatae; rhachides pallide fuscae, supra sublanuginoso-pilosae, subtus in juventute probabiliter ferrugineo-furfuraceae, laeves vel basin versus punctis sparsis, tuberculiformibus asperulae; rhachides secundariae basin versus squamulosae, squamulis iis stipitis similibus sed multo brevioribus; pili subappressi, crispatuli, ferruginei, rhachidis primariae ± decidui, rhachidum secundariarum persistentes. Pinnae multae, superiores patentes, sessiles, breves, profunde pinnatipartitae, sequentes ± horizontales, petiolatae, 2-pinnatipartitae, medianae vel inframedianae maximae, lineari-oblongae, usque 40 cm. longae, 15 cm. latae, acuminatae; pinnae inferiores abbreviatae, deflexae. Pinnulae subdimorphae, herbaceae, glabrae, contiguae vel approximatae, superiores ascendentes, sessiles, sequentes ± horizontales, subpetiolulatae, basi truncatae; pinnulae inframedianae maximae, steriles usque $7^1/_2$ cm. longae, $1^3/_4$ cm. latae, fertiles usque 6 cm. longae, $1^1/_3$ cm. latae, lateribus subparallelis, infra apicem subabrupte acuminatum, sensim serrato-denticulatum pinnatipartitae; costa supra ferrugineo-sublanuginosa, subtus cum costulis parce squamulosa, squamulis bullato-ovatis, brunneis, acuminatis. Lobi conferti vel approximati, patentes, infimi horizontales, lineari-oblongi, apice obtusi vel rotundati, steriles usque 9 mm. longi, 4 mm. lati, basin versus late crenulati, apicem versus obtuse serrato-dentati, fertiles usque 7 mm. longi, 3 mm. lati, basin versus subintegerrimi, apicem versus crenato-denticulati; venae usque 7—8 utrinque, furcatae, superiores simplices. Sori 1—2 utrinque, ad venas inferiores inframediani, costulam approximati; indusium globosum, scariosum, brunneum, in fragmentas lobuliformes 2 vel plures irregulariter rumpens; capsulae paraphysibus castaneis, squamuloso-fibrilliformibus intermixtae.

Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 600 m. (H. A. B. BÜNNEMEIJER, No. 5839, 19 May 1919).

Cyathea Zollingeriana METT. in Ann. Mus. Bot. L. B. I, 57; V. A. v. R. Mal. Ferns 20, 785; Supplem. I, 26, Corr., 42.

Plants gathered in Sumatra (Mt. Koerintji, H. A. B. BÜNNEMEIJER Nos. 9640, 9838) agree with the Javanese plants occurring in the Buitenzorg Herbarium under the name of *C. Zollingeriana* METT. except in the larger dimensions; they are distinguished as follows:

Stipes to 15 cm. long (with the frond narrowed gradually at the base) or to 65 cm. long (with the frond truncate at the base, and the stipe whether or not bearing a few much reduced pinnae to ± 15 cm. above

the base), reddish- or purplish-brown, ferrugineo-furfuraceous, asperous by innumerable minute, conical elevations and sparingly scaly, as are the main and secondary rhachises; scales of the stipe rather long, lanceolate, pale- or yellow-brown, very long-acuminate, with the margin darker, when young copiously fimbriate, at length erose; of the secondary rhachises much smaller, narrower. Fronds to ± $2^1/_2$ m. long including the stipe, deeply 3-pinnatipartite, sub-3-pinnate; main rhachis provided beneath with 2 opposite rows of rather small, somewhat elevated, truncate-conoid tubercles (aërophores), especially below or between the bases of the lower pinnae besides 1—3 somewhat larger tubercles at the bases of the pinnae. Pinnae elongate-lanceolate, acuminate; largest pinnae subsessile, to ± 50 cm. long and 18 cm. broad, with the rhachis above hirsute with somewhat crisped, ferrugineous or castaneous hairs, beneath provided with small, solitary, conoid tubercles at the bases of the pinnulae; reduced lower pinnae (if present) proportionally long-stalked. Pinnulae coriaceous, rather rigid, naked, dark above, paler beneath, the largest horizontal, sessile, lanceolate-triangular, to 8—9 cm. long, to 2—$2^1/_2$ cm. broad at the base, deeply pinnatipartite at the middle, deeply pinnatifid in the upper part, gradually serrate-crenate at the acuminate apex, pinnate at or towards the base; costa above hirsute, beneath deciduously ferrugineo-furfuraceous and -squamulose, the scales flat, lanceolate, erose or somewhat fimbriate-ciliolate. Segments nearly close linear-oblong, mostly somewhat falcate, blunt to subacute, the higher minutely serrulate-crenulate, the central and lower more distinctly and irregularly serrate-crenate at the middle, the lower free, adnate or the lowest subpetiolulate, truncate at the base, horizontal; largest segments to $1^1/_4$ cm. long, 3 mm. broad; costula above naked, beneath chaffy, especially between the sori; veins to 10—12 on a side, mostly forked, sometimes twice forked, the higher simple. Sori costular, to 5—7 on a side, not occupying the higher veins, the lowest close to the costa; indusium pale-brown, cupuliform, the mouth somewhat constricted, at length breaking down into 2—4 persistent lobes or fragments.

Cyathea arthropterygia V. A. V. R.

Stipites ± 55 cm. longi, in sicco pallide brunnei, sursum muriculato-asperuli, deorsum gibbis minutissimis, conicis et basibus tuberculiformibus persistentibus squamarum decessarum asperi, ceterum minutissime ferrugineo-ochraceo-furfuracei, mox glabrescentes; squamae deciduae, anguste subulatae, fuscae, setulis brevibus, acutis, obscure brunneis vel atro-rubris, erectis remote ciliolatae. Frondes ± $1^1/_2$ m. longae, profunde 3-pinnatipartitae, sub-3-pinnatae, abrupte breviter acuminatae, basi truncatae; rhachis primaria in sicco pallide flavido-brunnea, deorsum parcissime punctato-asperula, cum rhachidibus secundariis supra pilis brevibus, curvatis, rufis tomentosa, subtus pilis brevibus, crispatis, furfuriformibus, ochraceis puberula, mox glabrescens. Pinnae patentes, subsessiles vel inferiores breviter petiolatae, basi pseudo-

articulatae; pinnae maximae 55–60 cm. longae, 18–20 cm. latae. Pinnulae papyraceae, glabrae, contiguae, basi articulatae, superiores centralesque sessiles, ascendentes, longe acuminatae, inferiores vel infimae brevissime petiolulatae, horizontales, paullo reductae, obtusae vel breviter obtuse acuminatae; pinnulae maximae elongato-lanceolatae vel -oblongae, 9–10 cm. longae, in medio $1^3/_4$—$2^1/_4$ cm. latae, rectae vel subfalcatae, profunde pinnatipartitae, acumine crenatae vel dentato-crenatae, basi saepe pinnatae; costa supra brunneo-puberula, subtus ochraceo-furfuraceo-puberula, mox glabrescens. Segmenta remotiuscula, patentia vel infima horizontalia, maxima lineari-oblonga, usque ad $1^1/_4$ cm. longa, usque ad 3 mm. lata, obtusa, superiora crenulata, sequentia grosse dentata (potius lobato-dentata), basi postica lobulo decurrenti abrupte oblique dilatata; segmenta inferiora vel infima saepe libera, paullo abbreviata, elongato-clavata, basi angustata adnata; costula supra glabra, subtus paleis minutis, lanceolatis, bullatis, acuminatis, pallide brunneis munita; venae usque ad 8—10 utrinque, in dentibus vel lobulis ultimis furcatae vel parce pinnatim ramosae, superiores simplices. Sori 1—2 (vel plus?) utrinque, venas inferiores occupantes, costulares vel infimi postici subcostulares; receptaculum ad basin squama distincta, brunnea, saepe regulariter orbiculari, plana vel scutelliformi cinctum.

Sumatra: Mt. Koerintji, in forest, alt 2000 m. (H. A. B. BUNNEMEIJER No. 10352, 8 May 1920).

Cyathea longipes v. A. v. R.

Stipites ± 115 cm. longi, in sicco pallide rufo-fusci, basin versus parce squamosi, spinis conicis, subacutis aculeati et basibus persistentibus squamarum decessarum tuberculati, ceterum ochraceo-ferrugineo-furfuracei, aërophoris longitudinalibus, lineari-oblongis, depressis muniti, sursum (cum parte inferiore rhachidis primariae) spinulis minutis conicis aculeolati; squamae longe subulatae, castaneae, graciliter longe acuminatae, margine pallidiores, erosae vel fimbriato-laceratae. Frondes ovato-lanceolatae, ± 125 cm. longae, profunde 3-pinnatifidae, subabrupte breviter acuminatae; rhachis primaria supra rufo- vel castaneo-hirsuto-tomentosa, subtus (cum rhachidibus secundariis) mox glabrescens, laevis vel parcissime muriculato-asperula. Pinnae ascendentes, superiores sessiles, inferiores petiolatae; pinnae maximae lineari-lanceolatae, ± 55 cm. longae, media parte 15 cm. latae, apice sensim acuminatae; pinnulae subcoriaceae, glabrae, remotae, triangulari- vel lineari-lanceolatae, superiores sessiles, ascendentes, inferiores petiolulatae, horizontales; pinnulae medianae maximae $7^1/_2$ cm. longae, ad vel supra basin $1^3/_4$ cm. latae; costa supra rufo-hirsuta, subtus pilis caducis, pallidis, lanuginosis et squamulis planis lanceolatis, laceratis munita, glabrescens. Segmenta approximata, patentia, lineari-oblonga, subfalcata, usque ad 1 cm. longa, 3 mm. lata, obtusa, superiora integerrima vel subcrenulata, cetera crenulata vel crenata, infima postica saepe libera, crenata vel crenato-dentata; costula supra glabra, subtus parce, minute

lacerato-squamulosa; venae usque ad 8—11 utrinque, supra distinctissimae, furcatae vel interdum 3-furcatae, superiores simplices. Sori 1—3 utrinque, costulares, ad venas inferiores positi; indusium tenuissime scariosum, pallidum, mox dilaceratum, basi persistente, brunnescenti, rotunda, plano-patelliformi.

Sumatra: Mt. Koerintji, in forest, alt. 2200 m. (H. A. B. BÜNNEMEIJER No. 9642, 19 April 1920).

Cyathea acanthopoda v. A. v. R.

Stipites ± 90 cm. longi, in sicco brunnei, deorsum squamosi, spinosi, sursum (cum parte inferiore rhachidis primariae) spinulosi et inter spinulas punctis innumerabilibus asperuli, ceterum decidue ferrugineo-ochraceo-furfuracei; squamae longe subulatae, rigidae, castaneae, graciliter longe acuminatae, pallidius eroso-marginatae, ± deciduae, basibus persistentibus tuberculiformibus; spinae obtusae vel obtusiusculae, inferiores quam superiores majores, subcylindraceo-conoideae. Frondes probabiliter magnae, profunde 3-pinnatipartitae, sub-3-pinnatae; rhachis pallide brunnea, supra pilis pallide brunneis, crispatis, flexuosis vel curvatis tomentosa, ceterum decidue furfuracea, parce squamosa, sursum parce minute spinulosa, copiose asperulo-puncticulata; squamae iis stipitis similes sed angustiores. Pinnae ascendentes vel inferiores patentes; pinnae inframedianae maximae, breviter petiolatae, 50—60 cm. longae, subabrupte, breviter acuminatae; rhachis (cum costis) pallide brunnea, supra castaneo-hirsuto-tomentosa, subtus glabra (glabrescens?); rhachis pinnarum inferiorum parce minute spinulosa, indistincte puncticulata, pinnarum superiorum laevis. Pinnulae firmiter herbaceae, glabrae, subcontiguae, sessiles vel subpetiolulatae, superiores ascendentes, inferiores patentes aut horizontales vel infimae plus minusve deflexae; pinnulae inframedianae maximae, elongato-lanceolatae, usque ad 10—12 cm. longae et 2—2$^1/_2$ cm. latae, infra apicem acuminatum profunde pinnatipartitae, basi truncata pinnatae, acumine sursum crenulato, deorsum sensim pinnatifido. Segmenta lineari-oblonga; segmenta mediana maxima, 1—1$^1/_2$ cm. longa, 2—3 mm. lata, obtusiuscula vel acutiuscula, crenulata vel crenata, sterilia latissima, subcontigua, basi confluentia, fertilia angustissima, paullo remota, basi ala costali angustissima unita; segmenta inferiora libera, plus minusve abbreviata, basi adnata vel truncata et subpetiolulata; costula supra glabra, subtus basin versus decidue, pallide scarioso-squamulosa, squamulis inferioribus planiusculis, superioribus subbullatis, acuminatis; venae usque ad 8—11 utrinque, furcatae vel medianae 3-furcatae, superiores simplices, omnes subtus pilis minutissimis, appressis, glanduliformibus munitae. Sori costulares, usque ad 6 utrinque, venas superiores non occupantes; indusium postremo squamiforme, pallide scariosum, eroso-orbiculare, basim receptaculi cingens.

Sumatra: Mt. Koerintji, in forest, alt 2200 m. (H. A. B. BÜNNEMEIJER No. 10294).

Cyathea trachypoda V. A. V. R.

Stipites ± 75 cm. longi, in sicco pallide brunnei, parte inferiore parce squamosi, spinis brevibus, subacutis, conicis aculeati et basibus persistentibus squamarum decessarum tuberculati, ceterum aërophoris oppositis, 2-seriatis, longitudinalibus, lineari-oblongis, depressis muniti, decidue ochraceo-furfuracei, sursum (cum parte inferiore rhachidis primariae) gibbis minutis, conicis, subacutis aculeolati et punctis minutissimis asperuli; squamae longe et anguste lineares, castaneae, pallide eroso-marginatae, caducae. Frondes elongatae, ± 150 cm. longae, profunde 3-pinnatifidae, apice subabrupte breviter acuminatae; rhachis primaria supra rufo-hirsuto-tomentosa, subtus pallida, flavido-brunnea, cum rhachidibus secundariis in juventute probabiliter ochraceo-furfuracea, mox glabrescens, sursum laevis vel parcissime muriculato-asperula. Pinnae ascendentes, superiores sessiles, inferiores petiolatae; pinnae inframedianae maximae, elongato-lanceolatae, usque ad 50 cm. longae, breviter acuminatae. Pinnulae firmiter papyraceae, glabrae, subcontiguae, superiores ascendentes, ceterae patentes vel inferiores horizontales; pinnulae inframedianae maximae, subpetiolulatae, ± 8 cm. longae, $1^1/_2$ cm. latae, infra apicem acuminatum, sensim crenulatum profunde pinnatifidae, basi truncata pinnatae vel subpinnatae; costa supra rufo-hirsuta, subtus in juventute probabiliter squamulosa squamulis iis costularum similibus, mox glabrescens. Segmenta approximata, lineari-oblonga, patentia vel inferiora horizontalia, subfalcata vel inferiora recta; segmenta maxima fere 1 cm. longa, $2^1/_2$ mm. lata, obtusa, margine in sicco anguste recurvata, integerrima vel hic illic subcrenulata; segmenta infima libera vel cum segmentis sequentibus ala costali angustissima unita; costula supra glabra, subtus squamulis paucis, pallidis, scariosis, lanceolato-ovatis, planiusculis vel subbullatis munita; venae usque ad 8—11 utrinque, furcatae vel interdum 3-furcatae, superiores simplices, subtus pilis caducis, appressis, minutissimis, glanduliformibus munitae, mox glabrae. Sori 1—3 utrinque, costulares, ad venas inferiores positi; indusium postremo squamiforme, rotundum, scariosum, brunneum, erosum, basem receptaculi cingens.

Sumatra: Mt. Koerintji, in forest, alt. 2200 m. (H. A. B. BÜNNEMEIJER No. 10205, 6 May 1920).

Cyathea ternatea V. A. V. R.

Truncus usque ± 7 m. altus. Stipites cum rhachide obscure purpureo-brunnei, in sicco castanei; stipites spinis acute-conicis copiose aculeati, decidue castaneo-furfuracei, basi decidue castaneo-subulato-squamosi. Frondes profunde 3-pinnatifidae, potius 3-pinnatipartitae, apice abrupte acuminatae; rhachis primaria subtus in juventute ferrugineo-furfuracea, certe parte inferiore spinulis brevibus, acute conicis aculeolata, supra breviter castaneo-puberula, postremo glabrescens. Pinnae superiores ascendentes, sessiles, inferiores horizontales, petiolatae, maximae + 70—75 cm. longae, parte inferiore 20—25 cm. latae, abrupte acuminatae; rhachis punctis acutis, sparsis asperula,

ceterum rhachidi primariae similis. Pinnulae firmae, haud coriaceae, glabrae, paullo remotae, e basi pro portione lata, truncata lineari-lanceolatae, rectae vel falcatae (in- vel decurvatae), superiores ascendentes, sessiles, inferiores + horizontales, breviter petiolulatae, maximae $12^1/_2$ cm. longae, $2^1/_2$ cm. latae, profunde incisae, apice longe acuminato serratae; costa supra beviter castaneo-pubescens, subtus decidue ferrugineo-pubescens et squamulis parvis, oblongis, laceratis, castaneis, deciduis munita. Segmenta approximata, patentia, lineari-oblonga, subfalcata, mediana maxima, + $1^1/_4$ cm. longa, $3^1/_2$ mm. lata, acuta, margine anguste recurvata, serrulata vel crenato-serrulata, denticulis simplicibus vel 2-crenulatis aut 2-serrulatis; costula supra glabra, subtus squamulis sparsis, ferrugineis, subbullatis ornata; venae obliquae, usque 10—12 utrinque, superiores simplices, ceterae furcatae vel hinc inde duplicato-furcatae, subtus leviter prominentes. Sori minuti, ad venas ± mediani; capsulae probabiliter paraphysibus articulatis intermixtae; indusium parvum, squamiforme, orbiculare, brunneum, basin receptaculi cingens.

Ternate: Foramadiahi, in forest, alt. 600 m. (V. M. A. BEGUIN No. 1126, 14 November 1920); North Foramadiahi, in forest, alt. 1300 m. (V. M. A. BEGUIN No. 1521, 13 March 1921).

Cyathea arachnoidea HK., Hk. Bk. Syn. Fil., 42; v. A. v. R. Mal. Ferns 26.

BEGUIN's Nos 1461 and 1545 from Ternate (North Foramadiahi) have the stipes black or purple black, shortly, acutely spinulose, densely rusty-tomentose, the base clothed with crowded, long and fine, subfiliform, glossy, yellow-brown scales.

Cyclophorus cinnamomeus v. A. v. R.

Niphobolus. — Rhizoma repens; squamulae oblongae vel ovatae, raro acutae, peltatae, appressae, crebrae, in medio obscure rufae, margine late scariosae, pallidae, integerrimae. Frondes sessiles, isomorphae, breviter lineares vel ligulatae, $2^1/_2$ — 10 cm. longae, ad vel infra medium 6 — 10 mm. latae, apice obtusae ad acutiusculae, margine integerrimae, certe in sicco conspicue recurvatae, basi sensim angustatae, flaccido-coriaceae, in sicco cinnamomeae, supra mox glabrae, subtus tenuiter appresso-tomentosae, pilis steltis crebris, breviter ramulosis, cinnamomeis, in medio rufis; costa distincta; venae absconditae. Sori in parte superioris frondium, in juventute potius annuliformes, in tomento non immersi.

Near *C. acrostichoides* PR., but much smaller and sessile.

Java: Banjoemas Residency, along Karang Kobar River, epiphytical on *Heritiera littoralis* DRY., alt. 1 m. (C. A. BACKER No. 31539, 9 May 1921).

Cyclophorus adnascens (SW.) DESV. in Berl. Mag. V, 300; v. A. v. R. Mal. Ferns 681. — *Polypodium adnascens* SW. Syn. 25, 222, tab. II, fig 2.

Forma **dichotoma**: Fertile fronds varying from once forked to irregularly dichotomous.

Saleijer: Bitombang (W. DOCTERS VAN LEEUWEN No. 1659.).

Cyclophorus asterosorus (BK.) C. CHR. Ind. Fil. 198; V. A. V. R. Mal. Ferns 694; forma *subfurfuracea* V. A. V. R. Bull. Btz. II (1920), 140.—*Polypodium asterosorum* BK. in Journ. of Bot. XVIII, 214.

A collection of several specimens recently gathered by BÜNNEMEIJER proves that this species is very variable and that the type and the form considered by me to be distinct from the type are running into each other so gradually that it is impossible to draw the precise line of demarcation.

Rhizome wide-creeping, slender, branched, clothed with moderately large, pale- or yellow-brown, lanceolate, membranaceous, slightly crisped, finely long-acuminate, entire or very minutely denticulate scales peltate and adpressed at the base, spreading in the upper part. Stipes remote, $1^1/_2$—15 cm. apart, $1^1/_2$—15 cm. long, soon naked, when dry pale-brown. Fronds linear-lanceolate, linear or linear-oblanceolate, $7^1/_2$—35 cm. long, $^3/_4$—$2^1/_2$ cm. broad, the edge often narrowly recurved, the base narrowed gradually, the apex subacute or more commonly suddenly, shortly and bluntly mucronate-acuminate or occasionally longer and more acutely acuminate. Texture more or less coriaceous, thin to thick, flaccid to rigid; upper surface naked (glabrescent?); under surface coated with a more or less thin, tomentiform or furfuriform layer of pale (whitish or brownish), much adpressed, crisped, crowded, interlaced, very fine hairs intermixed with and surpassed by numerous short-stalked, long-branched, rufous stellate hairs; main veins ascending, obscure, enclosing several longitudinally quadrangular areolae; included veinlets simple or forked, excurrent or recurrent, free or connected. Sori rather lage, remote or crowded, occupying the upper $^1/_3$—$^2/_3$ of the frond, not reaching the margin, placed in 2—3 rows between the main veins, 5—6 in a row, when young hidden under the thin layer of tomentum; capsules intermixed with rufous stellate hairs.

By the venation intermediate between §§ *Niphobolus* and *Niphopsis*. Sumatra.

Davallia solida (FORST.) SW. in SCHRAD. Journ. 1800², 87; V. A. V. R. Mal. Ferns 305.—*Trichomanes solidum* FORST. Prod. 86.

Forma **tomentella** RST. in FED. Rep. XIII, 213; V. A. V. R., Supplem. I, 224.—A plant from Poeloe Sebesi near Sumatra (W. DOCTERS VAN LEEUWEN No. 5077), referrible to this form, has the sori with the indusium narrowly cylindrical, ± 3—5 times as long as broad.

Dictyopteris distincta V. A. V. R.

Arcypteris. —Stipites usque ad 8 cm. longi vel longiores, cum rhachide costisque obscure fusci, fere nigro-brunnei, parce fusco-squamulosi, postice parce fibrillosi, glabrescentes, antice dense castaneo-glanduloso-fibrillosi. Frondes oblongae, ± $27^1/_2$ cm. longae et $12^1/_2$ cm. latae, abrupte acuminatae,

pinnatae. Pinnae firmiter herbaceae, glabrae; pinna terminalis late deltoidea, longitudine fere dimidium longitudinis frondis metiente et subaequilata, profunde pinnatifida, apice subulato-acuminata et subrepanda, lobis inferioribus sensim in pinnas superiores transientibus, infimis ad rhachidem breviter cuneatim decurrentibus; pinnae laterales ± 5 utrinque; pinnae superiores majores, patentes, lineares, maximae ± 8 cm. longae et basi subtruncata 2 cm. latae, infra apicem acute subulato-acuminatum fere $^1/_2$ costam versus lobatae, basi antica anguste, postica late adnatae, breviter cuneatim decurrentes; pinnae inferiores conspicue abbreviatae, infimae brevissime petiolulatae, deflexae, oblongae, breviter acuminatae. Lobi approximati, patentes, plus minusve falcato-oblongi, obtusi vel obtusiusculi, subintegerrimi, praesertim ad basin parcissime ciliolati; venae in vivo indistinctae, in sicco distinctiores: loborum venae superiores liberae, simplices vel furcatae, inferiores Pleocnemiae more plus minusve anastomosantes; partis aliformis pinnarum venae Aspidii more copiose anastomosantes; areolae irregulares, venis liberis paucis, brevibus. Sori suboblongi, demum rotundati, utroque latere venarum primariarum 1-seriati, superiores marginem approximati, ad venas venulasve liberas, inferiores ad venulas anastomosantes positi.

The description is taken from a specimen cultivated in the Buitenzorg Gardens.

Sumatra: Deli, Sibolangit (W. DOCTERS VAN LEEUWEN).

Dictyopteris compitalis V. A. V. R.

Arcypteris. — Planta magna, robusta. Truncus usque 50 cm. altus. Stipites cum rhachidibus pallide brunnei vel fusci, primum ferrugineo-furfuracei vel-velutini et squamulis filiformibus, subcrispatis, brunneis muniti, postremo glabrescentes, parte superiore stipitis hinc inde pinnis reductis, auriculiformibus munita. Frondes stipite incluso 2—3 m. longae, abrupte acuminatae, parte inferiore profunde 3-pinnatifidae, basi 4-pinnatifidae. Pinnae infimae non-reductae maximae, ascendentes, usque 70 cm. longae vel longiores, petiolatae, remotae, patentes vel horizontales, copiose pinnatae. Pinnulae papyraceae, subsessiles, supra glabrae, subtus ad costas venasque appresso-pilosulae, pilis brevibus, fibrilliformibus, partim persistentibus, partim deciduis, iis costarum squamulis minutis, brunneis, sparsis, deciduis intermixtis; pinnulae superiores lineares, pinnatifidae, lobis subremotis, oblongis, subfalcatis, usque 3 mm. longis, 2 mm. latis, integerrimis vel subintegerrimis, obtusis; pinnulae infimae anticae pinnarum infimarum profunde pinnatifidae vel-partitae, usque 10 cm. longae et 2 cm. latae, lobis (in plantis juvenilibus) iis pinnularum superiorum similibus vel (in plantis adultis) elongatis, usque 1 cm. longis, 3 mm. latis, repando-crenatis; pinnulae inferiores posticae pinnarum infimarum productae, petiolulatae, usque 40 cm. longae parte inferiore profunde 2-pinnatifidae, foliolis pinnulis superioribus similibus. Lobi sinu obtuso, denticulo minuto munito separati; venae superiores simplices vel plerumque furcatae, medianae et inferiores Pleocnemiae more

anastomosantes, utrinque latere costarum et partis inferioris costularum areolas 1- vel interdum 2-seriatas formantes. Sori inter costam marginemque mediani, superiores ad apices ramulorum venarum furcatarum et mediani inferioresque ad venas anastomosantes positi.

Sumatra: Deli, near Bandar-baroe, in secondary forest, alt. 800 m. (J. A. LÖRZING Nos. 6378 [type], 6380, 24 April 1919).

Diplazium dolichosorum COPEL. in Philipp. Journ. Sci. Ic, Supplem. 151; V. A. V. R., Mal. Ferns 417.

Var. **aculeolatum**: Stipites cum parte inferiore rhachidum primariae secundariarumque spinulis multis, brevibus, acutis, fragilibus aculeolatae. Pinnulae firmiter herbaceae.

Ternate: North Foramadiahi, in forest, alt. 1350 m. (V. M. A. BEGUIN No. 1490, 9 March 1921).

Diplazium cardiomorphum V. A. V. R.

Eudiplazium. — Rhizoma breve, erectum Stipites fasciculati, 7½—15 cm. longi, specie decidue et brevissime fibrillosi, basin versus distincte sed non copiose, ceterum parcissime squamosi; squamae basi peltata rotundata subulatae, brunneae, acute et longe acuminatae, subcrispatae, minute dentatae, dentibus saepe patentissimis et apice 2-fidis, denticulis patentissimis, decurvatis. Frondes coriaceae, glabrae, ovato-, oblongo- vel obovato-cordatae, apicem plus minusve abrupte et breviter acuminatum versus serrulatae, ceterum integerrimae, lobis posticis plerumque costula brevi munitis; costa supra cristis angustissimis, elevatis canaliculata, inter cristas brevissime brunneo-fibrillosa, subtus prominens, decidue fibrillosa; venae venulaeque patentes, parallelae; venulae 2—3 utrinque, apicibus conspicue fusiformi-incrassatis et incurvatis. Sori ad venulas; indusium brunneum.

The description is taken from a young, sparingly soriferous specimen. Resembles at first sight D. cordifolium BL., which, however, differs in having the veins anastomosing in the outer half of the frond, with the vein tips not thickened, not upcurved, except when united with the next higher vein tip, all connected by a thickened marginal strand.

Java: Mt. Boerangrang, Pasir Limoes, in forest near water side, alt. 1000 m. (R. C. BAKHUIZEN VAN DEN BRINK, No. 4459, 23 July 1920); Tjisalak, Tjingèntjah, in forest, alt. 600 m. (R. C. BAKHUIZEN VAN DEN BRINK, F. No. 662, 22 December 1920).

Diplazium apatelium V. A. V. R.

Eudiplazium. — Stipites firmi, glabri, pallide brunnei, basi fusci. Frondes stipite incluso usque 2 m. longae, profunde 3-pinnatipartitae; rhachis pallide brunnea, glabra (glabrescens?). Pinnae patentes vel subhorizontales,

usque 50 cm. longae, acuminatae; rhachis pallide brunnea, certe subtus decidue, pallide ferrugineo-fibrillosa. Pinnulae tenues, glabrae, paullo remotae, superiores ascendentes, late adnatae, sequentes sensim horizontales et breviter petiolulatae, e basi lata, truncata lanceolatae; pinnulae maximae usque 10 cm. longae et $2^1/_2$ cm. latae, infra apicem longe acuminatum serratumque profunde pinnatipartitae; costa subtus pallide ferrugineo-fibrillosa. Segmenta paullo remota, sinu obtuso vel truncato separata, ala costali angustissima connata, horizontalia vel subhorizontalia, serrulata vel dentata vel maxima lobata; segmenta maxima lineari-oblonga, usque 12 mm. longa et 4 mm. lata, apice obtusa, acute serrulata; venae ± 6 utrinque, obliquae, superiores simplices, ceterae furcatae vel infimae parce pinnatae. Segmenta ultima (lobi dentesve) obliqua, apice 2—4-serrulata. Sori brevissimi, suboblongi, ad basin venarum positi, infimi antici costam contingentes; indusium rudimentare, tenuiter membranaceum.

The indusium is hardly detectable, consisting of 2-4 closely placed, fimbriate squamules hidden under the sorus even when young.

Ternate: North Foramadiahi, in open forest, alt. 1400 m. (J. A. LÖRZING No. 1506, 11 March 1921).

Diplazium subpolypodioides V. A. V. R., Bull. Btz. XX (1915), 11; Mal. Ferns & All. Supplem. I, 273,

BÜNNEMEIJER'S No. 8586 from Mt. Koerintji, consisting of several complete specimens, resembles very much MATTHEW'S old, incomplete plant on which this species has been founded. BÜNNEMEIJER'S plants have the general aspect of *D. polypodioides* BL., and are distinguished as follows: Stipes when young very copiously scaly towards the base, less so towards the apex; scales deciduous subulate from a slightly tuberculiform, persistent base, fuscous, entire or sparingly denticulate, the lower the largest, the higher growing gradually shorter. Fronds with the rhachises sparingly asperulous by the persistent, hardly elevated, subtuberculiform bases of fallen scales. Largest pinnulae of the smaller plants subsessile or shortly petiolulate, about 6 cm. long by $1^1/_2$ cm. broad, with the lobes ± 3 mm. broad; costa beneath sparingly squamulose, glabrescent. Sori short, occupying at best the lower half of the veins.

Diplazium permirabile V. A. V. R.

Anisogonium. — *D. prolifero* THOUARS affine, sed squamis stipitum copiosis, longissime stipitatis.

Caudex to ± 30 cm. high. Stipes to ± 1 m. long, when fresh dark-grey-brown or ferrugineous, when dry dirty-brown or fuscous, copiously scaly throughout; scales linear-subulate from a peltate-cordate base, brown, black-margined, minutely, horizontally 2-fisso-denticulate, each scale borne on the apex of a horizontally spreading, soft, flexible, spiniform protuber-

ance often longer than the scale itself (fig. a). Fronds large, to $2^1/_2$ m. long, the rhachis smooth and naked, or scaly like the stipe, pale- to fuscous-brown when dry, 2—3-sulcate. Pinnae thin and flaccid or subcoriaceous, somewhat remote, the higher sessile, the lower more or less stalked, the largest 15 — 35 cm. long, 5 — 10 cm. broad, acuminate, entire or serrate to lobed, the serratures or lobes entire or serrulate, the base rotundate-cuneate or abruptly and broadly cuneate to truncate-cordate; main veins copious, to 36 on a side; veins oblique, 6 — 12 on each side of the main ones, all anastomosing regularly except those near the margin. Sori numerous, occupying all the veins except the higher ones and therefore not reaching the margin; indusium narrow, brown, asplenioid or here and there diplazioid; sporae sparingly, reticulately winged.

Fig. a.

In forest; alt. 500 — 1500 m. — According to one of the labels a very beautiful, ornamental fern.

Sumatra: West-coast, Mt. Talamau (H A.B. BÜNNEMEIJER No. 512, 28 April 1917); Mt. Singgalang (BÜNNEMEIJER No 2764, 29 May 1918); Mt. Malintang (BÜNNEMEIJER Nos. 4314*a*, 4316, 5 August 1918); Mt. Koerintji (BÜNNEMEIJER No. 8665, 9 March 1920); East-coast, Sibolangit (J. A. LÖRZING No. 5562, 14 March 1918); Betimoes-valley (LÖRZING No 5577, 20 March 1918); Bandar-baroe (LÖRZING No. 7001, 12 November 1020, the most distinguished specimen).

Diplazium proliferum (LAM.) THOUARS, Flor. Tr. d'Ac. 35; v. A. v. R. Mal. Ferns 424; Supplem. I, 275; this Bull. XXVIII (1918), 20. — *Asplenium proliferum* LAM., Enc. II, 307.

The Buitenzorg specimens, as far as still provided with scales, have the stipes slightly muriculate and scaly at the base, the scales sessile, linear-subulate, brown or fuscous, not black-margined, minutely, horizontaly, acutely 2-fisso-denticulate, entirely deciduous or with a persistent, thickened, tuberculiform base; rhachis smooth and naked.

Var. **accedens**. — *D. accedens* BL., Enum. Pl. Jav. II, 192: Like the type but the stipes spinulose throughout, the rhachis sometimes so, naked.

Dryopteris auriculifera v. A. v. R.

Lastrea. — Rhizoma breve, dense squamosum; squamae lineari-subulatae brunneae, decidue breviterque ciliolatae, acuminatae. Stipites ± 50—60 cm. longi, pallide brunnei, in juventute dense breviterque pallide puberuli, postremo plus minusve glabrescentes. Frondes ovatae, ± 50 cm. longae, acuminatae,

pinnatae; rhachis dense persistente breviter pallide puberula. Pinnae coriaceae sed non rigidae, supra glabrae, subtus inter venas copiose minutissime decidueque puberulae et glandulosae; pinna terminalis elongato-deltoidea, basi profunde pinnatipartita, apicem versus sensim repanda; pinnae laterales ± 17 — 20 utrinque, lineari-lanceolatae, infra apicem sublonge acuminatum integerrimumque profunde pectinato-pinnatifidae, superiores sessiles, basi latissimae, inferiores distincte petiolatae, basi paullo angustatae; pinnae maximae ± 13 cm. longae, 2 cm. latae; pinnae inferiores quam sequentes non vel vix breviores; petiolus cum costa supra sulcata et dense, pallide pubescens, subtus pilis vel setis longis, pallidis, acicularibus copiose munitus. Segmenta copiosa, patentissima, e basi paullo dilatata lineari oblonga, subfalcata, usque $^3/_4$ cm. longa, $^1/_3$ cm. lata, apice obtusiuscula, margine leviter revoluta, integerrima, pro portione longe ciliata; segmentum infimum anticum pinnarum inferiorum liberum, a sequenti remotum, ± in medio petioli positum, minutissimum, oblongum, maxime 1 —2 mm. longum; costa cum venis supra glabra vel parce, pallide setulosa, subtus non copiose setoso-pilosa; venae obliquae usque ad ± 10 utrinque, simplices. Sori ad venas inframediani; indusium membranaceum, pallide brunneum, indistincte glandulosum et ciliolatum.

Lingga Island: Mt Tanda, in forest, alt. 600 m. (H. A. B. BÜNNEMEIJER No. 6905, 21 July 1919).

Dryopteris vinosicarpa V. A. v. R.

Lastrea. — Rhizoma repens. Stipites seriati, approximati, ± 10—30 cm. longi, frondium fertilium quam sterilium longiores, in vivo sordide rubri, in sicco straminei vel pallide brunnei, deorsum glabrescentes, sursum cum rhachide pilis brevibus, curvatis, pallidis copiose muniti. Frondes subdimorphae, elongato-ovatae, 20 — 25 cm. longae, $7^1/_2$—10 cm. latae, acuminatae. Pinnae chartaceae, glabrae; pinna terminalis deltoidea, apice subulata, acutiuscula vel obtusiuscula, integerrima, basin versus sensim profunde pinnatipartita, segmentis lineari-oblongis, obtusis, integerrimis; pinnae laterales ± 6 — 7 utrinque; pinnae superiores in segmenta basales pinnae terminalis sensim transientes; pinnae inframedianae maximae, brevissime petiolulatae, lineari-oblongae, ± $3^1/_2 — 4^1/_2$ cm. longae, basi truncata vel subcordato-truncata $1^1/_2$ cm. latae, margine infra apicem integerrimum + usque ad $^1/_2$ costam versus incisae; pinnae infimae paullo abbreviatae, paullo longius petiolulatae, deflexae, basi plus minusve angustatae; pinnae steriles confertae vel approximatae, apice triangulares, obtuse rotundatae; pinnae fertiles remotae, apice triangulari-subulatae, obtusiusculae vel acutiusculae; costa costulaeque supra parce pilosulae, subtus plus minusve pubescentes, squamulis parvis, pallide brunneis et glandulis minutissimis, globosis, flavidis parce munitae. Lobi breviter oblongi, plus minusve ciliolati, subfalcati, infimi horizontales, ceteri plus minusve obliqui, maximi 3 — 4 mm. lati, obtusi, integerrimi; venae usque ad 6 — 7 utrinque, sim-

plices, infimae posticae a costa ortae. Sori ad venas mediani vel inframediani, inferiores divaricantes, infimi turmarum contiguarum approximati vel contigui; capsulae paraphysibus clavatis, longe stipitatis intermixtae, in vivo pallide vinosae; paraphyses in vivo obscure vinosae, in sicco brunneo-rubrae; sporae cristis aliformibus, plus minusve reticulatis munitae; indusium minutum, rudimentare, cuneatum, apice rotundatum, integerrimum vel parce ciliatum, inter capsulas mox absconditum, deciduum.

The description is taken from a specimen cultivated in the Buitenzorg Gardens.

Sumatra: Bengkoelen, Lebong Tandai (C. J. BROOKS).

Dryopteris megalocarpa V. A. V R.

Lastrea. — Rhizoma erectum. Stipites approximati, basi atri et longe pilosi, ceterum (cum rhachide) brunnei vel fusci, copiose breviter puberuli; pili pallidi, flavidi vel rufi, longiores (basales) articulati, decidui, breviores (ceteri) non articulati, acuti, plus minusve persistentes. Frondes ± 20 cm. longae, profunde 2-pinnatifidae, fertiles ad stipites longissimos. Pinnae herbaceae, inter venas glabrae, paullo remotae, sessiles, 5—7½ cm. longae, 1—1½ cm. latae, infra apicem longe acuminatum, crenatum profunde pinnatifidae, basi profunde pinnatipartitae, interdum subpinnatae; pinnae terminales, superiores centralesque basi latissimae, inferiores basi paullo angustatae; pinnae superiores ascendentes, centrales horizontales, inferiores plus minusve deflexae, non reductae; costa copiose rufo-pubescens, postremo plus minusve glabrescens. Segmenta oblonga, approximata, subconferta, patentissima vel horizontalia, maxima 5—7½ mm. longa, 3 mm. lata, margine integerrima, subappresso-ciliolata, apice late rotundata; costula venaeque parce appresso-puberulae, mox glabrescentes; venae usque 4—6 utrinque, obliquae, simplices. Sori copiosi, majusculi, specie costulares (i. e. receptaculo subcostulari); indusium pallide brunneum, pilosum; sporae reticulato-alatae.

Sumatra: Patjoer-batoe near Toba Lake, rare, in forest, alt. ± 1400 m. (J. A. LÖRZING No. 7134, 27 January 1920).

Dryopteris superficialis V. A. V. R., Bull. Btz. XX (1915), 12; Mal. Ferns & All. Supplem. I, 155.

Rhizome short. Stipes approximate. Fronds 75—135 cm. long. Pinnae 2—3½ cm. broad, the lower stalked, with the stalk winged by the narrowly cuneate, dentate base of the pinna, the lowest whether or not somewhat reduced; suprabasal pinnae largest, 20—30 cm. long. Lobes straight or somewhat falcate, the largest with ± 20 veins on a side; veins oblique, straight or slightly curved, the lower strongly upcurved from a subhorizontal base, the lowest whether or not meeting in the sinus but not anastomosing. Spores provided with small, roundish, tuberculiform or short, irregularly ruguliform projections.

Also in Sumatra: Deli, Sibolangit, in forest, alt. 350 m. (J. A. LÖRZING No. 6338, 17 March 1919).

Dryopteris purpurascens (BL.) CHRIST in Philipp. Journ. II^{c}. 213; V. A. V. R., Mal. Ferns 201; Supplem. I, 168. – *Aspidium purpurascens* BL., Enum. Pl. Jav. II, 169.

When the plants occurring in the Buitenzorg Herbarium under the name of *D. purpurascens* CHRIST are correctly determined, this species is either variable with very different ultimate forms united by intermediates that are more or less agreeing with one of the ultimates or it is a so-called „collective species", which may be spliced into several distinct though related species different in aspect. Our Buitenzorg specimens are distinguished as follows: Main rhachis like the upper part of the stipe, pale-brown to castaneous, smooth or punctate- to verruculose-asperulous by the persistent bases of fallen scales; divisions (principal and partial) contiguous to remote, shortly acuminate to caudate, with the largest ultimate segments contiguous to remote, ascending or horizontal, sessile or shortly petiolulate, linear-oblong to subrhomboidal, entire or crenate, serrate or dentate to lobate-sinuate; veins oblique, 3 – 6 on a side in the largest ultimate segments, simple, forked or even sparingly pinnate; sori small to relatively large; spores when ripe provided with reticulated winglike crests.

Dryopteris tabacicoma V. A. V. R., Bull. Btz. XVI (1914), 11; Mal. Ferns & All. Supplem. I, 172.

Spores probably provided with reticulated wing-like crests.

Dryopteris subalpina V. A. V. R.

Nephrodium. — Rhizome probabiliter breve vel erectum. Stipites 30—35 cm. longi, cum rhachide pallide fusci, dense pallideque puberuli; pili stipitum ± decidui, rhachidum persistentes; pili postici minutissimi, piiis paullo longioribus intermixti, pili antici paullo longiores, setis longiusculis, acutis intermixti. Frondes lanceolato-ovatae, pinnis inferioribus abrupte reductis exclusis 60—70 cm. longae, $22^{1}/_{2}$—$27^{1}/_{2}$ cm. latae, acuminatae; rhachis subtus ad basin pinnarum glandulis (aërophoris) distinctis, elevatis, tuberculiformibus munita. Pinnae herbaceae, subremotae, sessiles, supra inter venas parce, breviter appresso-pilosae, subtus copiose, minutissime flavido-globoso-glandulosae; pinnae superiores patentes; pinnae inframedianae maximae, ± horizontales; pinnae inferiores non-reductae deflexae; pinnae maximae e basi subtruncata lineari-lanceolatae, $1^{1}/_{2}$—2 cm. latae, infra apicem sensim acuminatum, integerrimum vel subintegerrimum ± $^{3}/_{4}$ costam versus incisae; pinnae reductae remotae, $^{3}/_{4}$ partem superiorem stipitum occupantes, superiores parvae, subauriculiformes, inferiores minutissimae, costa supra ± pallide hirsuta, subtus minute, pallide puberula. Lobi

patentes, subremoti, lineari-oblongi, subfalcati, usque 10 mm. longi et 3 mm. lati, obtusi, integerrimi, infimi subhorizontales; costa supra parce pallide setulosa, subtus pallide appresso-puberula; venae usque 8—10 utrinque, simplices, infimi solum anastomosantes. Sori parvi, ad venas infimas inframediani vel ad omnes venas positi et superiores ad venas mediani vel supramediani; indusium persistens, brunneum, glabrum vel parce puberulum.

Ternate: North Foramadiahi, in forest, alt. 1200 m. (V. M. A. BEGUIN No. 1496, 9 March 1921).

Dryopteris plurifolia V. A. V. R.

Nephrodium. — Caudex erectus, 20—30 cm. altus, foliis 6—10 munitus. Stipites 40—80 cm. longi, cum rhachide pallide brunnei et dense, minute puberuli. Frondes ovato-lanceolatae, usque 90 cm. longae vel longiores, rhachide subtus ad bases pinnarum aërophoris elevatis munita. Pinnae herbaceae, supra (praesertim ad venas) setulis brevibus longisque, pallidis munitae, subtus (venis exceptis) glabrae, lineari-lanceolatae, sessiles, acuminatae, infimae non-reductae maximae, $17^1/_2$—25 cm. longae, 2—$3^1/_2$ cm. latae, profunde pinnatifidae, basin versus angustatae; pinnae steriles longissimae latissimaeque, approximatae, segmentis confertis; pinnae fertiles brevissimae angustissimaeque, segmentis + remotae; pinnae reductae remotae, fere usque ad basin stipitum productae, superiores auriculiformes, inferiores sensim glanduliformes; costa supra setulis brevibus longisque, pallidis, acutis copiose hirsuta, subtus (cum costulis venisque) dense, pallide appresso-pubescens. Segmenta patentia, lineari-oblonga, levissime falcata, integerrima, appresso-ciliolata, obtusa; segmenta sterilia usque 15 mm. longa, 5 mm. lata, basi paullo dilatata; segmenta fertilia usque 9 mm. longa, $2^1/_2$ mm. lata, basi distinctius dilatata; venae in segmentis maximis 11—13 utrinque, ascendentes, simplices, hinc inde furcatae, infimae tantum anastomosantes. Sori ad venas omnes mediani, contigui inferiores divaricati; indusium in juventute conspicue purpureo-brunneum, parce puberulum.

Near *D. heterocarpa* O. KTZE, which, however, has both barren and fertile pinnae equal or nearly equal in size, placed on slight increasings of the rhachis but without aërophores at the base, and the indusium seemingly not purplish when young.

Sumatra: Deli, Bandar-baroe, in secondary forest, alt. 800 m. (J. A. LÖRZING No. 6393, 24 April 1919, intermixed with *D. heterocarpa* O. KTZE).

Dryopteris cyrtocaulos V. A. V. R.

Nephrodium. — Stipites + 30—75 cm. longi, pallide fusci, parte inferiore glabrescentes, aërophoris longitudinaliter elongatis, depressis et basibus persistentibus, tuberculiformibus squamarum decessarum asperi, dimidia parte superiore pinnis remotis, pluribus, alternantibus, abrupte et valde

reductis, auriculiformibus muniti, ceterum cum rhachide dense puberuli, pilis pallide brunneis, partim persistentibus, partim deciduis, anticis quam posticis longioribus. Frondes ovato-lanceolatae, pinnis reductis exclusis + 40—75 cm. longae, subabrupte acuminatae; rhachis subtus ad bases pinnarum glandulis (aërophoris) solitariis, elevatis, tuberculiformibus, fragilibus munita. Pinnae multae, herbaceae vel firmiter papyraceae, utrinque copiose puberulae, patentes, sessiles; pinnae inframedianae maximae, lineares, 10—17½ cm. longae, basi truncata vel cuneato-truncata 2—3 cm. latae, margine $^2/_3$—$^3/_4$ costam versus incisae, apice acuminatae; pili pallidi; pili antici persistentes; pili antici parenchymatis copiosi sed non densi, appressi, breviusculi, pili antici costae densi, longiusculi, ascendentes, acute setiformes; pili postici brevissimi parenchymatis sparsi, glandulis minutissimis, subglobosis, flavidis, deciduis intermixti, caduci, costae costularum + densi, persistentes. Lobi patentissimi infimi saepe horizontales, lineari-oblongi, saepe subfalcati, integerrimi, obtusi, margine in sicco recurvati; lobi maximi $^3/_4$—1$^1/_4$ cm. longi, 2—4 mm. lati; lobi fertiles quam steriles breviores et angustiores; venae usque ad 8—11 utrinque, simplices vel interdum furcatae; venae infimae anastomosantes, plantarum majorum sequentes apicibus saepe breviter contiguae vel in sinu confluentes. Sori saepe venas omnes occupantes, marginem quam costulam magis approximati; indusium firmum, persistens, brunneum, breviter puberulum; sporae dense, graciliter echinatae.

This species is represented in BÜNNEMEIJER's collection by 3 numbers. The largest specimen, destitute of its rhizome but with the most distinctly recognizable characteristics, has the pinnae somewhat dimorphous, i. e. the barren pinnae are more approximate, somewhat shorter and broader and shorter-acuminate than the fertile ones, with the lobes closer; the smaller specimens have an erected rhizome, the characteristics less conspicuous, and the barren and fertile pinnae less unequal in shape and dimensions. — No. 9922 is the largest specimen.

Sumatra: Mt. Koerintji, in forest, alt. 2100—2300 m. (H. A. B. BÜNNEMEIJER Nos. 9922, 9923, 10199, 1—6 May 1920).

Dryopteris dicranogramma V. A. v. R.

Nephrodium. — Stipites 45—55 cm. longi, pinnis abrupte, valde reductis, tuberculiformibus, remotis, 2-seriatis muniti, parte inferiore brunnei, decidue ferrugineo-furfuracei, dense puncticulato-asperuli et spinulis brevibus, acutis, castaneis copiose aculeolati, parte superiore glabri (glabrescentes?), cum rhachide primaria pallide brunnei et parce muriculati. Frondes lanceolato-ovatae, 50—70 cm. longae, 25—30 cm. latae, abrupte acuminatae; rhachis primaria subtus ad bases pinnarum glandulis (aërophoris) altis, curvato-subuliformibus (hamatis) munita, primum (cum costis costulisque) probabiliter pilis setuliformibus, flavidis vel rubris ornata, mox glabra. Pinnae coriaceae, glabrae, numerosae, paullo remotae, plus minusve patentes, superiores sessiles, medianae inferioresque subpetiolulatae; pinnae inframedianae maximae,

lineares, usque ad 15 — 17$^1/_2$ cm. longae, basi truncata 1$^1/_2$ — 1$^3/_4$ cm. latae, margine $^1/_3$ — $^1/_2$ costam versus incisae, apice sensim acuminatae et serrulatae; pinnae normales inferiores basi paullo angustatae; costa supra prominens, sulcata, glabra, subtus prominens, ad bases costularum inferiorum medianarumque glandulis parvis, conicis munita. Lobi numerosi, contigui, obliqui, suboblongi, subcucullati, 3 — 4 mm. lati integerrimi, obtusi (marginibus valde recurvatis specie acuti); venae usque ad 8 — 10 utrinque, pro portione crassae, supra valde distinctae, 4 — 5 inferiores anastomosantes. Sori usque ad 8 utrinque, contigui, dispositi in formam litterae V, i. e. superiores saepe subcostulares, ceteri sensim divergentes, infimi turmarum contiguarum confluentes; indusium mox in fragmentas rumpens, in juventute probabiliter pilis setiformibus, rubris ciliatum; sporae dense, minute echinatae. — Rhizoma non vidi, probabiliter breve.

A very remarkable species resembling at first sight *D. cucullata* CHRIST.

Sumatra: Mt. Koerintji, in forest, alt. 2400 m. (H. A. B. BÜNNEMEIJER No. 10454, 10 May 1920).

Dryopteris perrigida V. A. V. R., Bull. Btz. XVI (1914), 27. - *Phegopteris perrigida* V. A. V. R., l.c.; Mal. Ferns & All. Supplem. I, 317.

Nephrodium. — Indusium present, very small, rudimentary.

Dryopteris urophylla (WALL.) C. CHR., Ind. Fil. 299; V. A. V. R. Mal. Ferns 216; Supplem. I, 177, 503.

Var. **peraspera**: Pinnae ubique subdense verruculosae, basi truncatae, margine subintegerrimae vel serrulato-crenatae, venis secundariis minus copiosis; sori indusio setuloso.

New Guinea near Pionier Bivak, in forest, alt. 10 m. (H. J. LAM Nos. 666, 677, 17—20 July 1920).

Dryopteris tandikatensis V. A. V. R., Bull. Btz. XI (1913), 11; Mal. Ferns & All. Supplem. I, 178, 503.—*D. urophylla* C. CHR. var. *Teysmannii* V. A. V. R., Bull. Btz. XXVIII (1918), 24.

Elaphoglossum dolichaulon V. A. V. R.

Aconiopteris. — Rhizoma breviter repens; squamae ovatae, in juventute pallide brunneae vel flavido-brunneae, acutae vel acuminatae, integerrimae vel subintegerrimae, postremo obscurae, obtusae, deciduae. Stipites pro ratione longi, 4 — 6 vel plerumque 7 — 11 cm. longi, glabri vel (cum costa subtus) parce ovato-squamulosi. Frondes coriaceae, supra glabrae, subtus squamulis minutissimis, rotundatis, subfimbriatis, deciduis, sparsis munitae, oblongo- vel lanceolato-ovatae, 4$^1/_2$ — 6$^1/_2$ cm. longae, 1$^1/_2$ — 2$^1/_2$ cm. latae, apice sensim acuminatae, margine subcartilagineae, in sicco leviter revolutae, basi in frondibus pro ratione brevibus latibusque abrupte cuneato-acuminatae, in frondibus pro ratione longis angustisque sensim acuminatae,

subdecurrentes; costa distincta; venae copiosae, graciles, simplices vel furcatae, in sicco leviter prominentes. Frondes steriles fertilesque subsimiles.

Near *E. angulatum* MOORE and perhaps a local derivative of it

Java: Besoeki, Jang Mounts, very dry ground on slope of the Walirang-crater, alt 3050 m. (J. JESWIET No. 348, 24 October 1913).

Elaphoglossum angulatum (BL.) MOORE, Ind. 5; V.A.V.R., Mal. Ferns 713; Supplem. I, Corr., 59. — *Acrostichum angulatum* BL. Enum. Plant. Jav. II, 101.

Also in Sumatra (Mt. Koerintji, H. A. B. BÜNNEMEIJER Nos 9852, 10038), Luzon (Benguet, Pauai, R. C. MCGREGOR, Bur. of Sci., No. 8384, received under the name of *E. laurifolium* MOORE), Ceylon (G. WALL No. 10500, received under the name of *Acrostichum conforme* SW.). — BÜNNEMEIJER's Sumatran specimens are small, with the stipes $1^1/_2 - 9$ cm. long, and the fronds $5 - 20$ cm. long by $1 - 3^1/_2$ cm. broad.

Gleichenia linearis (BURM.) CLARKE in Trans. Linn Soc. II, Bot. I, 428; V. A. V. R., Mal. Ferns 59, 795; Supplem. I, 83 — 85. — *Polypodium lineare* BURM. Flor. Ind. 235, tab. 67, fig. 2.

Var. **crassifrons**: Var. *rigidae* affinis. — Segmenta ultima minus rigida, subremota, subtus glabra, haud numerosa, linearia vel lineari oblonga, relative lata, margine anguste recurvata, apice lobulato-emarginata, lobulis minutis, obtusis, sinu angusto separatis; venae distinctae, in sicco supra prominentes; sori capsulis magis numerosis.

Ternate: North Foramadiahi, on petrified lava at border of crater, alt. 1500 m. (V. M. A. BEGUIN No. 1501, 11 March 1921).

Var. **bidentata**: Var. *rigidae* affinis. - Segmenta ultima minus rigida, subremota, subtus in juventute ad costulam tomentosa, mox glabrescentia, numerosa, linearia vel lineari-oblonga, relative angusta, margine plus minusve conspicue recurvata, apice 2-dentata, dentibus subacutis, plerumque sinu rectangulari separatis; venae distinctae, in sicco supra prominentes; sori capsulis magis numerosis.

Lingga: Mt. Bakong, border of jungle, alt. 10. m. (H. A. B. BÜNNEMEIJER No. 7617, 19 August 1919), Riouw Archipelago: Poeloe Bintan, Mt. Bintan, in forest, alt. 350 m. (H. A. B. BÜNNEMEIJER No. 6182, 13 June 1919); Poeloe Karimon, Mt. Djantan, road side in jungle, alt. 40 m. (H. A. B. BÜNNEMEIJER No. 7881, 7 September 1919).

Gleichenia hispida METT.; KUHN in Verh. zool. bot. Ges. XXV, 600; V. A. V. R., Mal. Ferns 61.

Ultimate segments to 4 cm. long in the fully developed plant.

Also in Sumatra: Mt. Koerintji, river side in forest, alt. 2200 m. (H. A. B. BÜNNEMEIJER No. 9915, 1 May 1920).

Hemitelia rudimentaris V. A. V. R.

Amphicosmia. – Stipites 50 cm. longi vel forsitan longiores, in specimine esquamosi, in sicco pallide fusci, in juventute ferrugineo-furfuracei, basin versus aculeolati, apicem versus cum rhachide muricati, spinulis brevibus, acute conicis, ceterum cum rhachide inter spinulas puncticulato-asperuli. Frondes ovato-oblongae, 110 — 120 cm. longae, acuminatae; rhachis supra cum rhachidibus secundariis 3-sulcata, pilis castaneis hirsutula, subtus glabra, in juventute probabiliter ferrugineo-furfuracea. Pinnae multae, cum rhachide pseudo-articulatae, superiores ascendentes, sessiles, parvae, profunde pinnatipartitae, sequentes horizontales vel subhorizontales, breviter petiolatae, 2-pinnatipartitae, acuminatae, inframedianae maximae, ± 35 cm. longae; rhachis subtus punctis minutis, acute tuberculiformibus asperula. Pinnulae multae, firmiter herbaceae, glabrae; pinnula terminalis deltoidea, basin versus profundissime remoteque pinnatipartita; pinnulae laterales cum rhachide articulatae, superiores parvae, ascendentes, sessiles, in lobos infimos pinnulae terminalis sensim transientes, sequentes + horizontales, brevissime petiolulatae, lineari-oblongae, infra apicem sensim serrato-dentatum, acuminatum pinnatipartitae, medianae vel inframedianae maximae, fere 6 cm. longae, usque $1^1/_4$ cm. latae, basi subtruncata paullo angustatae; costa supra subcastaneo-hirsutula, subtus squamulosa, squamulis lanceolatis, brunneis, subintegerrimis. Lobi patentes, approximati, lineari-oblongi, obtusi, serrulato-denticulati, mediani maximi, 6 mm. longi, 2 mm. lati; costula subtus glabra vel parce, minutissime squamulosa, squamulis bullatis, rufis, acuminatis; venae usque 10 utrinque, furcatae, superiores simplices. Sori usque 7 utrinque, conferti, ad venas inframediani, venas superiores non occupantes; capsulae paraphysibus fibrilliformibus intermixtae; indusium rudimentare, minutissimum, vix conspicuum, brunneum, irregulariter fimbriato-lobulatum.

Near *H. latebrosa* METT.

Lingga: Panggak, in forest, alt. 60 m. (H. A. B. BÜNNEMEIJER No. 7057, 27 July 1919).

Forma **major**: A forma typica differt dimensionibus omnibus majoribus. Stipites usque 100 cm. longi, in sicco rufo-brunnei. Frondes usque 150 cm. longae. Pinnae usque 50 cm. longae. Pinnulae usque $7^1/_2$ cm. longae, fere $1^1/_2$ cm. latae, lobis usque 7 mm. longis, 3 mm. latis, crenulato-serrulatis.

Lingga: Resoen, border of forest, alt. 60 m. (H. A. B. BÜNNEMEIJER No. 6803, 18 July 1919).

Humata attenuata V. A. V. R.

Euhumata. – Rhizoma longe repens, ramosum, squamosum; squamae confertae, suberectae, elongato-lanceolato-ovatae, castaneae, parce decidue ciliolatae, acuminatae. Stipites sparsi, $2^1/_2$—$7^1/_2$ cm. longi, supra 2-marginato-canaliculati, cum costa subtus sparse squamulosi; squamulae minutae, acuminato-ovatae, brunneae. Frondes rigide coriaceae, glabrae, subdimorphae, e basi abrupte cuneato-subtruncata lineari-oblongae vel elongato-lineari-lanceolatae;

frondes steriles lineari-oblongae, 4–6 cm. vel plus longae, + 1 cm. latae, obtusae, apicem versus crenatae vel crenulatae, basin versus late lobato-crenatae vel lobatae, crenis integerrimis vel crenulatis, lobis crenulatis vel duplicato crenulatis; frondes fertiles longiores, usque 18 cm. longae, infra medium $1^3/_4$ cm. latae, apicem obtusiusculum versus sensim angustatae, parte superiore late, oblique truncato-dentatae, parte inferiore lobatae vel pinnatifidae, lobis subhorizontalibus, confertis vel subremotis, transverse oblongis vel semiorbicularibus, maximis + $^1/_2$ cm. longis, 1 cm. latis, apice rotundato-truncatis vel rotundatis et (cum apicibus dentium) subintegerrimis, repando-crenulatis, crenulatis vel duplicato-crenulatis; costa supra prominens, subtus subprominens vel deplanata; venae in lobis maximis 3—4, furcatae vel duplicato-furcatae, venulis latis, deplanatis, subhorizontalibus. Sori in apicibus dentium loborumque fertilium submarginales, minuti.

The veins are placed in groups of 3—4 in the largest lobes, springing from the same point, the lowest of each group subhorizontal, the highest of each group with the lower half running along the costa, becoming gradually subhorizontal towards the apex, each of them once or twice forked, so that there are 8—16 veinlets in the largest lobes. — Perhaps a local derivative of *H. angustata* J. SM.—Resembles in aspect superficially *Asplenium attenuatum* R. BR. (HK., Icon. Pl., X, tab. 914; HK. & GREV., Icon. Fil., tab. 220).

Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 700 m. (H. A. B. BÜNNEMEIJER No: 5829, 19 May 1919).

Humata mutata V. A. v. R.

Euhumata. — Rhizoma longe repens, ramosum; squamae copiosae, appressae, lanceolato-ovatae vel subulato-lanceolatae, brunneae, castaneae, subintegerrimae, longe acutae, postremo plus minusve deciduae. Stipites sparsi, 2—20 mm. longi, supra anguste 2-alato-canaliculati, glabri. Frondes rigide coriaceae, glabrae, e basi abrupte cuneata lineari-lanceolatae, 5—10 cm. longae, 1—$2^1/_2$ cm. latae, lobatae ad pinnatifidae, apice acuminato, sterili crenulato, fertili serrulato. Lobi horizontales, conferti vel approximati, in frondibus minoribus semirotundi, in frondibus majoribus obtuse oblongi vel deltoideo-oblongi, mediani vel infimi maximi, 2—9 mm. longi, 2—5 mm. lati, steriles subintegerrimi, crenulati vel serrulati, fertiles minores repando-crenati, fertiles majores serrati vel dentato-serrati; costa supra prominens, subtus subprominens vel deplanata; venae primariae in lobis pinnatim ramosae; venae secundariae suberectae, latae, deplanatae. Sori parvi, submarginales, inter dentes solitarii. — Plantae juveniles frondibus minoribus, sterilibus subintegerrimis vel crenulatis, fertilibus irregulariter repando-crenatis, serratis ad lobato-dentatis.

Perhaps a local derivative of *H. angustata* J. SM.

Lingga Island: Mt. Tanda, in jungle, alt. 900 m. (H. A. B. BÜNNEMEIJER No. 6900, 21 July 1919).

Humata Gaimardiana (GAUD.) J. SM. in Lond. Journ. of Bot. I, 425; V. A. V. R Mal. Ferns 286. — *Nephrodium Gaimardianum* GAUD. in FREYC. Voy. Bot. 335, tab. XII, fig. 1.

This species is said to have the segments entire and the surfaces naked. The specimens, however, occurring in the Buitenzorg Herbarium, have the fertile segments often, though not invariably, more or less distinctly repandulo-crenulate and it seems that the young fronds have the under surface often covered with woolly hairs or squamules (*H. lanuginosa* V. A. V. R., this Bull., II, 1920, 155).

Humata sessilifolia (BL.) METT., Fil. Lips. 102; V. A. V. R. Mal. Ferns 287.— *Davallia sessilifolia* BL., Enum. Pl. Jav. II, 231.

Var. **polypodioides**. — *H. polypodioides* BRACK., Expl. Exp., XVI, 228, tab. XXXII, fig. 1.— Specimens from Ternate (Foramadiahi, epiphytical in forest, alt. 650 m., V. M. A. BEGUIN No. 1431, 21 February 1921) have the fronds of the young, though fructiferous plants short-stalked, of the old plants long-stalked.

Humata alpina (BL.) MOORE, Ind. XCII; V. A. V. R. Mal. Ferns 290.— *Humata repens* DIELS var. C. CHR., Ind. Fil. 353, 354. — *Davallia alpina* BL. Enum. Pl. Jav. II, 231.

Distinct enough when typical specimens are shown but passing into *H. vestita* MOORE by intermediates so gradually that it is very difficult to draw the precise line of demarcation. *H. botrychioides* BRACK. and other species belong probably to these intermediates. — See also RACIBORSKI's information under *Davallia vestita* BL. in Flor. Btz., I, 127.

Humata squarrosa V. A. V. R., this Bull. II (1920), 156.

The original specimen of this is not to my disposal since it belongs to a private collection, so that I can not make comparisons with plants recently received from Sumatra (Deli, Bandar-baroe, in forest, alt. 850 m., J. A. LÖRZING No. 6897, 13 October 1919). — These plants have the rhizome scales not very finely acuminate, not conspicuously squarrose, the stipes 15—25 cm. long, the fronds lanceolate- to deltoid-ovate, 20—40 cm. long, 10—20 cm. broad, with the largest ultimate (tertiary) segments oblong, to + 6 mm. long by $2^1/_2$ mm. broad, finely crenulate to serrulate, and the sori often surpassed by an acute, horn-shaped toothlet.

Humata immersa (WALL.) METT., Fil. Lips. 102; V. A. V. R. Mal. Ferns 292. — *Davallia immersa* WALL. List No 256; C. CHR. Ind. Fil. 211.

Also in Ternate: North Foramadiahi, in forest, alt. 1350 m. (V. M. A. BEGUIN No. 1523, 13 March 1921).

Hymenophyllum pleiocarpum V. A. v. R.

Euhymenophyllum. – Rhizoma longe repens, subcrasse filiforme, ramosum, primum pilis rufo-brunneis, articulatis hirsutum, mox glabrescens. Stipites sparsi, 3–6 cm. longi, alati, imo decidue pilosi. Frondes firmiter membranaceae, glabrae, triangulari-ovatae vel -lanceolatae, 5–12½ cm. longae, 3–6 cm. latae, 3-pinnatifidae, acutae, rhachidibus alatis; alae plus minusve crispatae. Pinnae contiguae, patentes vel inferiores horizontales deflexaeve, maximae oblongo-triangulares. Pinnulae contiguae, pinnatifidae. Lobi simplices vel interdum 2-fidi. Segmenta ultima oblonga vel linearioblonga, usque 4 mm. longa, 1 mm. lata, indistincte crispatula, integerrima, apice rotundata vel emarginata; venae in segmentis solitariae, medianae. Rhachides cum costis venisque subtus fibrillis minutissimis, sparsis, furfuriformibus munitae, demum glabrescentes. Sori in planta adulta numerosi, terminales axillaresque, saepe segmenta abbreviata et paullo angustata coronantes; indusium profunde 2-valvum; valvae quam segmenta latiores, late ovatae, rotundatae vel transversaliter oblongae, integerrimae vel obsolete crenulatae; receptaculum breve latumque, plerumque subflabellato-cuneatum.

Sumatra: Mt. Koerintji, epiphytical in forest, alt. 1900–2400 m. (H. A. B. BÜNNEMEIJER Nos. 9142, 9245, 9313, 23 March – 9 April 1920).

Hymenophyllum lingganum V. A. v. R.

Leptocionium. — Rhizoma longe repens, intricatum, subfiliforme, in juventute pilosum; pili pallide ferruginei, caduci. Stipites filiformes ½ — 1½ cm. longi, cum rhachide primaria glabri vel parce pilosi. Frons firmiter herbaceae, glabrae, in sicco fuscae, ovato- vel lineari-oblongae, 4 — 8 cm. longae, 1½ — 2½ cm. latae, pinnatae; rhachis apicem versus plus minusve anguste alata, basin versus angustissime alata, potius marginata vel subnudata. Pinnae ascendentes, subcontiguae, 8 — 16 utrinque, 1 — 2 cm. longae, rhachide alata. Pinnulae conspicue ascendentes, 2 — 4 utrinque, simplices vel furcatae. Segmenta ultima usque 8 mm. longa, 1 mm. lata, margine plana vel vix crispata, subrevoluta vel -involuta, regulariter, munite serrulata, hic illic integerrima. Alae integerrimae. Sori ad lobos abbreviatos, subbasales, anticos pinnarum vel pinnularum terminales; indusium ⅓ — ½ basin versus 2-valve, valvis triangularibus vel oblongo-triangularibus, integerrimis vel apice obtuso ad subacuto minutissime crenulato-serrulatis, interdum distinctius crenatis, basi obconoideum, anguste alatum, extus parce spinulosum et (vel) cristulatum; receptaculum indusum, columnare.

Lingga Island: Mt. Daik, epiphytical in forest, alt. 300 m. (H. A. B. BÜNNEMEIJER No. 6621, 12 July 1919).

Hymenophyllum torricellianum V. A. v. R. Bull. Btz. XI (1913), 14; Mal. Ferns & All. Supplem. I, 95.

Texture firm-membranaceous; colour when dry fuscous.

Hymenophyllum brevidens V. A. V. R., Bull. Btz. VII (1912), 20; Mal. Ferns & All. Supplem. I, 96.

Near the preceding, but the stipes much thicker, and the serratures of the ultimate segments much shorter; surfaces when dry fuscous.

Hymenophyllum Reinwardtii V. D. B. in Ned. Kruidk. Arch. IV, 399; V. A. V. R., Mal. Ferns 80.

Specimens gathered in Sumatra (Mt. Koerintji, H. A. B. BÜNNEMEIJER Nos. 9245*b*, 9633, 9762, 9826, 9910, 9980) are distinguished in having the fronds larger, to 25 cm. long, to 10 cm. broad, the ultimate segments plane or nearly so; sori often axillary, and the valves of the indusium varying from round to broadly ovate or transversely oblong, quite entire. (Forma integrivalve).

H. J. LAM's No. 1782 from New Guinea has the edges more conspicuously crisped than usual.

Hymenophyllum sabinifolium BK., HK. BK. Syn. Fil. 71; V. A. V. R., Mal. Ferns 81.

This species is unknown to me.—Plants gathered in Sumatra (Deli, near Bandar-baroe, epiphytical in forest, alt. 850 m., J. A. LÖRZING No. 7010, 24 November 1919), which agree very well with BAKER's diagnosis of this, are, however, distinguished in having the dimensions much smaller; both stipes and fronds are at best $2^1/_2$ cm. long, and the latter roundish to deltoid, about as broad as long. The edges of the wings and segments are so strongly crisped that the relatively long, subulate-aristiform toothlets are spreading in various directions.

Lindsaya cyathicola COPEL. in Philipp. Journ. of Sci. I^C, Supplem. 149, tab. 5; V. A. V. R., Mal. Ferns 263.

A specimen received from Manila (Bur. of Sci., No. 32029; coll. J. K. SANTOS) is distinguished in having the stipes purplish at the very base only, for the rest brownish or stramineous, as is the rhachis, the rhachis 4-angular and more or less distinctly 4-sulcate, the leaflets with the lobes entire, or repandulo-crenulate at the truncate or rotundate-truncate apex, the sori mostly uniting the apices of 2—3 veinlets of forked or 3-furcate veins.

Lindsaya hymenophylloides BL., Enum. Pl. Jav. II, 218; V. A. V. R., Mal. Ferns 264.

V. M. A. BEGUIN'S No. 1116 from Ternate (Foramadiahi) has the leaflets with the higher segments simple, the central and lower segments varying from once to twice forked, and the apices of the ultimate segments rounded.

Lindsaya alpestris V. A. v. R.

Eulindsaya. — Rhizoma repens, ramosum, subcrasse setaceum, mox glabrum, castaneum, nitidum, basibus persistentibus squamarum paucarum, sparsarum, parvarum, linearium, pallide brunnearum, caducarum subasperulum. Stipites sparsi, 4—8 cm. longi, glabri, nitidi, castanei vel sursum (cum rhachide) straminei. Frondes lineari-lanceolatae, simpliciter pinnatae, 12½—30 cm. longae, 1½—2½ cm. latae, utrinque sensim angustatae; rhachis quadrangularis, supra conspicue, subtus vix canaliculata. Foliola herbacea, glabra, numerosa, inferioribus reductis exceptis contigua, obliqua; foliola mediana vel inframediana maxima, triangulari-rhomboidea, subtrapezioidea, ¾—1¼ cm. longa, basi cuneata usque ad 6 mm. lata, margine inferiore recta vel leviter incurvata, margine superiore + ½ costam versus lobata, apice rotundata vel oblique rotundato-truncata. Lobi + 3—4, breviter lineari-oblongi, sinibus acutis separati, simplices vel 2-fidi, steriles apice rotundati vel rotundato-acuti, integerrimi, fertiles apice rotundati vel rotundato-truncati, saepe paullo dilatati, integerrimi vel apice irregulariter crenulato-denticulati; venae graciles. Sori in lobis infraterminales, ad apices venarum solitarii vel apices venularum (venarum furcatarum) jungentes; indusium angustum, extrorsum curvatum.

Resembling at first sight the unbranched alpine form of *L. davallioides* BL. but with the veins not anastomosing, and the sori remote from the apices of the lobes.

Sumatra: Mt. Koerintji, epiphytical in forest, alt. 2100 m. (H. A. B. BÜNNEMEIJER No. 9907, 1 May 1920).

Lindsaya humilis KUHN; Ann. Mus. Bot. L. B. IV, 278; V. A. v. R., Mal. Ferns 268.— *L. adiantoides* J. SM. in Journ. of Bot. III, 415; HK. Spec. Fil. I, 204, tab. LXI C.

This species has, according to the diagnosis and figure given by HOOKER, mentioned above, the stipe and rhachis black, the leaflets alternate except the opposite lower ones, the terminal leaflet elongate-oblong, incised on both sides, bluntish at the narrowed tip, the lower leaflets somewhat remote.

The Buitenzorg Herbarium possesses no authentic material of this species but it has a plant from an unknown habitat, occurring under this name, agreeing very well with HOOKER's figure; it has, however the stipe and rhachis stramineous, quadrangular.

The Herbarium received under the name of *L. adiantoides* J. SM. a plant from the Philippines that agrees very well with the very incomplete diagnoses given by HOOKER, HOOKER and BAKER in Syn. Fil., 104, COPELAND in Polypod. Philipp. 62, but it differs absolutely from HOOKER's figure mentioned above, so that I am inclined to consider it as a species different from this, supposing that HOOKER's figure is correct. If I am right, I propose to call it:

Lindsaya tropidorachis V. A. V. R.

Eulindsaya. — Rhizoma brevissime repens, squamulis minutis, ferrugineis, crispatulis. Stipites approximati, subcontigui, 4 — 5 cm longi, cum rhachide castanei vel obscure brunneo-purpurei, glabri, triangulares, antice plus minusve concavi angulis acutis, lateraliter plani vel leviter convexi angulo postico graciliter acuteque carinato. Frondes lineari-oblanceolatae, 16—20 cm. longae, 2—2$^1/_2$ cm. latae, simpliciter pinnatae, apice obtusae, basin versus sensim angustatae. Foliola tenuia, pellucida, glabra, infra foliolum terminale cuneatum truncatum parvum copiosa, patentissima, subhorizontalia, opposita, subsessilia, centralia superioraque approximata vel contigua, inferiora sensim reducta et valde remota, infima late rotundato-cuneata; foliola centralia maxima, triangularia, usque 1$^1/_4$ cm. longa, basi 6 mm. lata, apice subacuta ad recte vel oblique truncata, margine inferiore recta vel apicem versus leviter sursum curvata, margine superiore $^1/_4$—$^1/_3$ incisa. Lobi 3—4, breviter et late quadrangulares, apice truncati vel rotundato-truncati et minute eroso-denticulati; lobus terminalis interdum brevissime 2-lobulatus; venae graciles, in lobis dupli- vel triplicato-furcatae. Sori in lobis terminales, apices ramulorum venarum conjungentes, transverse oblongi vel lineari-oblongi; sorus terminalis interdum interruptus; indusium tenue, margine minute eroso-denticulatum.

Resembles superficially *L. cultrata* SW.

Luzon: Caramines, Paracale (M. RAMOS & G. EDAÑO, November/December 1918, Bureau of Science No. 33778).

Lindsaya bullata V. A. V. R., Bull. Btz. XVI (1914), 20; Mal. Ferns & All. Supplem. I, 206.

BÜNNEMEIJER'S No. 9635a from Sumatra (Mt. Koerintji, alt. 1900 m) is a small or reduced (young?) form of this. It has the fronds with the base partly truncate, partly narrowed gradually.

Lindsaya canaliculatipes V. A. V. R.

Eulindsaya. — Rhizoma repens, intricatum, squamulis fibrilliformibus, castaneis vestitum. Stipites usque ad 1 cm. inter se remoti, 20 - 40 cm. longi, cum rhachide pallide brunnei vel fusci, glabri, obtuse quadrangulares, inter angulos distincte (antice distinctissime) canaliculati. Frondes 20 - 40 cm. longae, 2-pinnatae. Rami infra ramum terminalem 2 - 5 utrinque; ramus terminalis lineari-lanceolatus, usque 25 cm. longus, infra medium 1$^1/_2$ - 2$^1/_2$ cm. latus, apicem longe acutum versus sensim angustatus, basi paullo angustatus; rami laterales quam terminalis saepe breviores. Foliola membranaceo-herbacea, glabra, numerosa, approximata, subhorizontalia, subpetiolulata, rhomboideo-oblonga, $\pm$ $^3/_4$—1$^1/_4$ cm. longa, duplo angustiora, margine inferiore recta vel saepe leviter curvata, margine superiore exterioreque lobulata (maxime $^1/_3$ costam versus incisa), apice obtusa vel rotundata. Lobuli 3—4, apice rotundati vel subtruncati, integerrimi, retusi vel emar-

ginati. Venae in foliolis 3—4, simplices vel furcatae, marginem non attingentes. Sori in lobulis terminales, plerumque apices venularum venarum furcatarum conjugentes, breviter transverse oblongi vel magis transverse elongati; indusium subdavallioideum (basi lateribusque cum parenchymate affixum), margine integerrimum vel raro incisum.

The best developed fronds have the leaflets provided on the upper side with bullate vaultings corresponding with the sori.

Riouw Archipelago: Poeloe Toedjoeh, Mt. Ranai, in forest, alt. 500—600 m. (H. A. B. BÜNNEMEIJER Nos. 5835 & 5840, 19 May 1919.)

Lindsaya parallelogramma V. A. v. R.

Synaphlebium. — Rhizoma breviter repens, squamulis minutis, elongato-triangularibus, subfibrilliformibus, rufis vestitum. Stipites inter se $^1/_2$—1 cm. remoti, 10—15 cm. longi, cum rhachidibus specie acute quadrangulares, i.e. teretes vel obtuse quadrangulares, angulis crista anguste aliformi acute marginatis, ceterum glabri, straminei ad brunnei, basi basibus persistentibus squamulorum fibrilliformium saepe asperuli. Frondes 2-pinnatae. Pinnae pro portione breves lataeque, infra pinnam terminalem certe 1—2 utrinque, subsessiles, 6—12 cm. longae, $2^1/_2$—3 cm. latae, apice obtusae, acutae vel abrupte ad sensim, breviter ad longe acuminatae. Foliola tenuiter chartacea, glabra, in sicco pallide olivaceo-viridia, patentia vel subhorizontalia, sessilia, approximata, subparallelogrammiformia, maxima usque $1^1/_2$ cm. longa, $^1/_2$ cm. lata, leviter decurvata, semifacie superiore basi grosse crenata (potius lobato-crenata), apice profunde incisa. Lobi (lobo terminali incluso) 4—6, inferiores integerrimi vel parce crenati, superiores simplices vel apice 2—3-fidi, minores transverse oblongi, majores lineari-oblongi vel lineari-cuneati; lobi laterales supremi quam terminales plerumque longioris, omnes apicibus rotundatis vel rotundato-subtruncatis; venae graciles. Sori in lobulis subterminales, transverse oblongi, decurvati; indusium firmum.

Near *L. davallioides* BL.

Lingga Archipelago: Poeloe Singkep, Mt. Tjikaloe, in forest, alt. 130 m. (H. A. B. BÜNNEMEIJER No. 7359, 7 August 1919).

Lomagramma pteroides J. SM. in Journ. of Bot. III, 402; V. A. v. R., Bull. Btz. II (1920), 158; BAU. & HK. Gen. Fil. tab. XCVIII.

The specimens of this species and its varieties received from the Philippines have the scales of the stipes, rhachises and costae varying from grey to brown. — According to the plate mentioned above the sori have the capsules intermixed with long-stalked, peltate paraphyses; the specimens of the Buitenzorg Herbarium, however, have the ripe sori restitute of paraphyses, which may be due to age.

Lomagramma melanolepis V. A. v. R.

L. pteroideae J. SM. affinis. — Squamae rhizomatis, stipitum, rhachidum costarumque sparsae, nigrae vel obscure castaneae. Frondes steriles ± 60

cm. longae; rhachis apicem versus anguste alata; ala ad basin pinnarum superiorum brevius vel longius dentiformi-auriculata. Pinnae flaccidae firmiter herbaceae, subapproximatae, sessiles, patentes, in sicco olivaceae, supramedianae maximae, lineares, 12—13 cm. longae, $1^3/_4$—2 cm. latae, integerrimae vel apice acuminato, recto vel subfalcato remote subserrulato-crenulatae, basi obliquae et plus minusve inaequilaterae, rotundatae vel late rotundato-cuneatae; venae distinctae, pallidae (colore pinnarum). Frondes fertiles minores, usque ad 40 cm. longae, pinnis remotis, horizontalibus, contractis. Sori capsulis juvenilibus paraphysis longe stipitatis, peltatis copiose intermixtis.

Fertile frond of the specimen on hand still young, with the pinnae 5 cm. long, 3 mm. broad.

Ternate: Foramadiahi, in forest, alt. 700 m. (V. M. A. BEGUIN No. 1114, 13 November 1920).

Lygodium derivatum V. A. v. R.

Eulygodium. — Petioli primarii brevissimi vel subnulli, fasciculo pilorum fibrilliformium, ruforum vel castaneorum muniti; petioli secundarii 2—4 cm. longi, plus minusve decidue flavido-brunneo-puberuli, 2-marginati. Pinnae pinnatae, infimae maximae, usque 25 cm. vel plus longae lataeque; pinnae sequentes sensim minores, supremae maxime ± 10 cm. longae lataeque; rhachis leviter flexuosa, cum petiolulis pinnularum anguste alata et decidue puberula. Pinnulae infra pinnulam terminalem solitariae vel plerumque 1—2, saepissime 2 utrinque; pinnula terminalis simplex, furcata vel 2-foliolata; pinnulae sequentes pinnulae terminali similes; pinnula infima furcata, 2-foliolata vel pinnata, foliolis infra foliolum terminalem simplex, furcatum vel 2-foliolatum 1 utrinque. Segmenta ultima (lobi, folioli) coriacea, glabra vel glabrescentia, lineari-lanceolata, obtusiuscula ad acuta, margine leviter recurvata, crenulata, hic illic subintegerrima, basi utrinque subcordato- vel cuneato-truncata vel antice anguste cuneata; segmenta pinnarum infimarum maxima, usque 15 cm. longa, 2 cm. lata, pinnarum sequentium sensim minora, pinnarum superiorum minima, 4—8 cm. longa, 4—8 mm lata (fertilia spicis exclusis); costa basi haud nodosa; venae graciles, approximatae, apicibus venula spuria marginali, gracili unitae. Spicae in segmentis pinnarum superiorum, horizontales, confertae vel plus minusve remotae, usque 5 mm. longae; sporae .....

The spores of the material on hand were too young for examination. — Perhaps a local derivative of *L. circinatum* or *L. flexuosum* SW.

Lingga: Resoen, border of forest, alt 70 m. (H. A. B. BÜNNEMEIJER No. 6808, 18 July 1919).

Lygodium salicifolium PR., Supplem. Tent. Pterid. 102; V. A. v. R., Mal. Ferns 113.

Specimens gathered in the Kangean Archipelago (Sepandjang and Paliat Islands, C. A. BACKER Nos. 28758, 28870, 29334) have the fully

developed fronds with the leaflets thinly herbaceous, the largest leaflets to ± 15 cm long, 3-foliolate with the ultimate basal leaflets about half as long, the terminal leaflets not rarely cordate at the base, and the longest spikes to 1 cm. long.

Nephrolepis biserrata (Sw.) SCHOTT, Gen. Fil. ad tab. 3; V. A. v. R., Mal. Ferns 162. — *Aspidium biserratum* SW. in SCHRAD. Journ. 1800², 32.

Forma **typica**: Pinnae not auricled, or with an undeveloped, rather rudimentary auricle on the upper side or on both sides at the base.

Forma **aberrans**: Pinnae sometimes provided with an exceedingly long auricle on the upper side at the base.

Java: Meester Cornelis (C. A. BACKER).

Oleandra oblanceolata COPEL. in Philipp. Journ. Sci. VII^c, 64; V.A.v.R., Mal. Ferns & All. Supplem. I, 132.

A duplicate of MARY STRONG CLEMENS' No. 11053, occurring in the Buitenzorg Herbarium, differs from COPELAND's diagnosis in having the fronds thinly chartaceous, nearly parchment-like, the costa beneath provided with 2 opposite rows of very minute, horizontal, subulate-triangular, dark-brown squamules, and the sori not close to the costa.

Oleandra geniculata V. A. v. R., Mal. Ferns & All. Supplem. I, 132.

A specimen gathered by W. DOCTERS VAN LEEUWEN (Java, Taloen, Pengalengan No. 2347) has the rhizome scandent, and the knee-tips provided with 3—4 fronds (Forma plurifoliata).

Oleandra Whitmeei BK. in Journ. of Bot. XIV, 11; V.A.v.R., Mal. Ferns 154.

Rhizome scales partly persistent, partly deciduous, varying from yellow to pale- or dark-ferrugineous, the largest finely long-acuminate, entire or very obsoletely and remotely ciliolate. Stipes deciduously fibrillose and squamose, as is the costa, the scales similar to those of the rhizome, those of the costa placed on the under side, in 2 opposite rows. Fronds ciliolated with fine, short, articulated hairs. Sori with the indusium varying from yellow to ferrugineous.

This completion is taken from specimens received from Samoa (Savai, REINECKE No. 157), Mindanao (Todaya, ELMER No. 11451) and Sumatra (Mt. Koerintji, BÜNNEMEIJER No. 10300). Costal scales persistent in the Philippine and Samoan specimens, caducous in the Sumatran.

Ophioglossum pumilum (RAC.) V. A. v. R., Mal. Ferns 774; Supplem. I, 453. — *O. moluccanum* SCLECHT. forma *pumila* RAC. in Nat. Tijdschr. Ned. Ind. LIX, 237, tab. II, fig. 2—3.

Specimens gathered in Sepandjang Island (Kangean Archipelago, C. A. BACKER No. 28890) have some of the barren segments more elongated, cuneate-obovate, to 2 cm. long, $^3/_4$ cm. broad.

Phegopteris heterolepia V. A. V. R., Bull. Btz XVI (1914), 23; Mal. Ferns & All. Supplem. I, 310.

Var. **remota** V. A. V. R., l. c.

Subvar. **major**: Planta major; stipites usque ad 1 m. longi; frondes longitudine stipites aequantes, 3-pinnatae; pinnulae ultimae lineari-oblongae, obtusae vel obtusiusculae, superiores vel minores basi late adnatae, margine late crenatae, inferiores vel majores basi truncata plus minusve anguste adnatae, margine usque ad $^1/_2$ costam versus late et obtuse lobatae; venae in lobis majoribus pinnatim ramosae; venulae $\pm$ 2 utrinque, simplices vel furcatae.

Sumatra: Mt. Koerintji, in forest, alt. 2100 m. (H. A. B. BÜNNEMEIJER No. 9921, 1 May 1920).

Plagiogyria pycnophylla (KZE.) METT. Farng. II, Plag. 8; V. A. V. R., Mal. Ferns 343. — *Lomaria pycnophylla* KZE. in Bot. Zeit. 1848, 143.

Also in Sumatra: Mt. Koerintji, in secondary forest, alt. 2700—2900 m. (H. A. B. BÜNNEMEIJER Nos. 10046, 10049, 10389, 4—9 May 1920).

Pleocnemia Leuzeana (GAUD.) PR. Tent. Pterid. 184, tab. VII, fig. 12; V. A. V. R., Mal. Ferns 172. — *Aspidium Leuzeanum* KZE. in Bot. Zeit. (1846), 474; C. CHR. Ind. Fil. 79. — *Polypodium Leuzeanum* GAUD. in FREYC. Voy. Ur. Phys. Bot. 361, tab. VI.

Pinnulae sessile or short-stalked, the simple ones to 10 — 15 cm. long, $1^1/_2$ — 3 cm. broad, lobed $\pm$ $^1/_2$-way down to the costa, often provided with a small toothlet between each pair of lobes, the lowest posterior of the lowest pinnae commonly elongated, to $\pm$ 25 cm. long, to 8 cm. broad, pinnate, with the leaflets similar to the higher pinnulae but generally smaller. Sori medial or more commonly supramedial on the veins.

Forma **maxima**: Frondes stipite incluso usque 4 m. longae, valde copiose 3-pinnatifidae, pinnulis inferioribus posticis pinnarum infimarum valde elongatis, usque 75 cm. longis, usque 25 cm. latis.

Sumatra: Deli, Sibolangit, in forest, alt. 350 m. (J. A. LÖRZING Nos. 6329, 6336, 5 — 17 March 1919).

Pleocnemia porphyrocaulos V. A. V. R.

Caudex brevis, non arborescens. Stipites basi crassissimi, atro-purpurei, squamosi, ceterum decidue ferrugineo-villoso-furfuracei; squamae crebrae, longe et anguste lineari-subulatae, rufo-fuscae, minute denticulatae, dentibus horizontalibus, saepe decurvatis. Frondes magnae, 3-pinnatae, basi sub-4-pinnatifidae; rhachides costaeque brunneo-fibrillosae, plus minusve glabrescentes. Pinnae patentes, petiolatae, usque 135 cm. longae. Pinnulae subhorizontales breviter petiolulatae, lineari-triangulares, usque $22^1/_2$ cm. longae, basi 5 cm. latae, acuminatae, maximae profunde pinnatifidae, basi pinnatae, segmentis remotis, integerrimis ad dentatis, obtusis; pinnarum infimarum

(inferiorum?) pinnulae infimae posticae productae, lanceolato-oblongae, usque 35 cm. longae, 10 cm. latae, acuminatae, pinnatae, foliolis chartaceis, haud crassis, glabris, remotis, patentibus (subhorizontalibus), linearibus, usque 5 cm. longis, $1^1/_4$ cm. latis, acutis vel breviter acuminatis, profunde lobatis, basi profunde pinnatifidis, lobis patentibus (subhorizontalibus), paullo remotis, oblongis, usque 4 mm. longis, 2 mm. latis, obtusis, integerrimis vel crenulatis, sinu obtuso separatis; venae furcatae, in lobis longioribus areolas costales costularesque et in lobis brevioribus tantum areolas costales formantes. Sori ad venas mediani, $^1/_2$—$^2/_3$ partem apicalem loborum occupantes, pro portione magni, contigui, costulam marginemque loborum contingentes; indusium brunneum, plus minusve persistens.

Ternate: Foramadiahi, in forest, alt. 800 m. (V. M. A. BEGUIN No. 1123, 11 November 1920).

Pleopeltis parvifrons V. A. v. R., Bull. Btz., II (1920), 165.

Specimens recently gathered by BÜNNEMEIJER prove that the plants of the Buitenzorg Herbarium, doubtfully referred by me to *Pl. Wrayi* BEDD., are identical with this. The diagnosis should be corrected as follows: Rhizome scales when young rufous or ferrugineous. Stipes $1^1/_2$—$7^1/_2$ cm. long, those of the fertile fronds often though not invariably the longer ones. Barren fronds $2^1/_2$—$7^1/_2$ cm. long, the edge cartilagineous, very broadly and shallowly crenulated, whether or not somewhat recurved or reflexed. Texture varying from somewhat flaccid to rigid. Fertile fronds 3—15 cm. long. Sori close or somewhat remote.

It may be possible that this species is identical with *Pl. Wrayi* BEDD. of which I have not yet seen the authentic specimen. The diagnosis given by BEDDOME in Handb. Ind. Ferns, Supplem. 93, however, is too incomplete to decide on the subject.

Pleopeltis brevidecurrens V. A. v. R. ? *Pl. Werneri* V. A. v. R. forma vel var.

Eupleopeltis, Pleuridium. — Rhizoma longe repens, decidue albo-ceracea; squamae primum densae, triangulari- vel lanceolato-ovatae, ochraceae, integerrimae, apice longe acuto, deciduo, basi persistenti, peltata, subrotunda vel oblonga. Stipites sparsi, 4—16 cm. longi, pallide brunnei vel fusci, glabri. Frondes flaccido-coriaceae, glabrae, ovato-lanceolatae; frondes steriles 8—16 cm. longae, prope basin 4—6 cm. latae, basi late cuneatae, breviter decurrens, margine cartilagineo-incrassatae, anguste recurvatae, late sed levissime crenulatae, non aut plus minusve repandae, apice obtusae ad conspicue, acute acuminatae; costa supra sulcata, subtus prominens; venae primariae patentes, utrinque prominentes, marginem frondis fere attingentes; areolae primariae inter costam marginemque usque 8—9-seriatae, irregulariter quadrangulares; areolae secundariae valde irregulares; venulae liberae in diversas partes patentes. Frondes fertiles quam steriles maximae minores, areolis primariis

minus copiosis, ± 4 – 6-seriatis. Sori inter venas primarias 1-seriati, in aerolis primariis solitarii, rotundi, nonnumquam per paria confluentes.

Ternate: North Foramadiahi, creeping over stones in grassy jungle, alt. 1500 m. (V. M. A. BEGUIN No. 1503, 11 March 1921).

Pleopeltis linguaeformis (METT.) V. A. v. R., Bull. Dép. Agr. I. N. XXVII (1909), 6.— *Pl. musifolia* MOORE var. *Schumanniana* v. A. v. R., Mal. Ferns & All. Supplem. I, 391.— *Polypodium Schumannianum* DIELS in SCHUM. & LAUT. Flor. deut. Sch. geb. 139, tab. III, *C — D.* — *P. linguaeforme* METT. in Ann. Mus. BOT. L. B. II, 228; C. CHR. Ind. Fil. 540.

Rhizome creeping, firm, the scales more or less deciduous, linear- to ovate-lanceolate, fuscous, acuminate, minutely and more or less sparingly denticulate. Fronds ± 25 — 50 cm. long, to $6^1/_2$ — 13 cm. broad, varying from ovate-oblong or panduriform to lanceolate or spathulate, sessile with a dilated, cordate or rounded base to stalked with a long-decurrent base, the edge entire, the apex bluntish to relatively long-acuminate. Texture chartaceous to subcoriaceous; surfaces naked; main veins when dry distinct in the lower half, the higher often parallel, the lower often very irregular, all forked and evanishing gradually towards the apex, forming with the other veins 1 row or large primary areolae and beyond these 2—3 rows of smaller secondary areolae, all divided into numerous still smaller ones; ultimate areolae irregularly 4 – 6-angular, with included free veinlets. Sori numerous, occupying the upper part of the fertile fronds, scattered irregularly, more or less immersed, on free or joined veinlets, mostly solitary in the ultimate areolae. — Very variable, with the ultimate forms not rarely occupying the very same rhizome.

Eastern Malaya to Polynesia and Melanesia.

Pleopeltis congregatifolia V. A. v. R. in Bull. Btz. II (1920), 166. BÜNNEMEIJER's No. 8884 from Mt. Koerintji (Sumatra), agrees very well with this but it has the fronds somewhat firmer, rather subpapyraceous, more acutely acuminate at the apex, somewhat broader and rounded to slightly cordate at the base, and the sori somewhat larger.

Pleopeltis Zippelii (BL.) MOORE Ind., 348.— *Polypodium Zippelii* BL. Flor. Jav. II, 172, tab. LXXX; v. A. v. R., Mal. Ferns 649.

Also in Sumatra: Mt. Koerintji, in forest, alt. 1800—2400 m. (H.A.B. BÜNNEMEIJER Nos. 8430, 9554, 9583, 10288, 10292, 4 March—7 April 1920).

Pleopeltis triquetra (BL.) v. A. v. R., Bull. Dép. Agr. I. N., XXVII (1909), 9; Mal. Ferns & All. Supplem. I, 387.— *Polypodium triquetrum* BL., Enum. Pl. Jav. II, 124; v. A. v. R., Mal. Ferns 650; C. CHR. Ind. Fil. 571.

Sori in 2 rows between the main veins. — R. C. BAKHUIZEN VAN DEN BRINK's No. 4131 from Mt. Salak (Java) has the sori of each pair with the receptacles nearly all laterally confluent so as to form single rows of oblong sori between the main veins, parallel or subparallel with the costa or margin.

Pleopeltis platyphylla (Sw.) BEDD. Handb. Ind. Ferns, Supplem., 94.— *Polypodium platyphyllum* Sw. Syn. 27; V. A. V. R., Mal. Ferns 647; C. CHR. Ind. Fil. 554.

Also in Sumatra: Bengkoelen, Lebong Donok. (C.J. BROOKS No. 470/S).

Pleopeltis incurvata (BL.) MOORE in Gard. Chron (1860), 1105; V.A V.R. Mal. Ferns & All., Supplem. I, 399, Corr., 58, 59. — *Polypodium incurvatum* BL., Enum. Pl. Jav. II, 126; V. A. V. R., Mal. Ferns 665; C CHR. Ind. Fil. 535.

Forma **typica**: Sori round or oblong, the oblong ones parallel with the central ribs of the lobes.

Forma **transversalis**: A forma typica differt soris longioribus (oblongis) horizontaliter patentibus.

Java: Tjibodas Mountain Gardens, alt. 1425 m. (W. DOCTERS VAN LEEUWEN.)

Pleopeltis insignis (BL.) BEDD. Ferns Br. I., II, tab. 214.— *Polypodium insigne* BL., Enum. Pl. Jav. II, 127; V. A. V. R., Mal. Ferns 663; C. CHR. Ind. Fil. 535.

Also in Sumatra: Mt. Koerintji, in forest, on trees, alt. 1500 — 1700 m. (H. A. B. BÜNNEMEIJER Nos. 8745, 8944, 9040, 12 — 20 March 1920).

Pleopeltis pseudoloxogramma V. A. V. R.

Selligueа.— Rhizoma repens, firmum, sublignosum, subglabrescens; squamae coriaceae, deltoideo-ovatae, sordide brunneae, integerrimae, acutiusculae ad acuminatae, fragiles. Stipites breves, ± 1 cm. longi, basibus decurrentibus frondium saepe angustissime 2-marginati, subsemiteretes, supra leviter convexi, subtus rotundati [fig. *b* [1])]. Frondes papyraceae, glabrae, lineari-oblanceolatae, 30—45 cm. longae, ad vel saepius supra medium 3—5 cm. latae, basin acutam versus sensim angustatae, margine subcartilagineae sed non incrassatae, integerrimae, in sicco saepe angustissime recurvatae, apice acuminatae, interdum angustissime caudatae; costa utrinque prominens, supra obtuse quadrangularis, subtus obtuse triangularis [fig. *c* [1])]; venae primariae patentes, graciles, cum venis secundariis venulisque in sicco leviter prominentes, venis secundariis transversalibus unitae; venae transversales frondium sterilium valde irregulariter et acute flexuosae, frondium fertilium minus irregulares; venulae liberae inclusae numerosae. Sori lineares, venis primariis paralleli, costam marginemque frondium fere attingentes, superiores approximati, inferiores conspicue remoti.

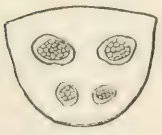

Fig. b.

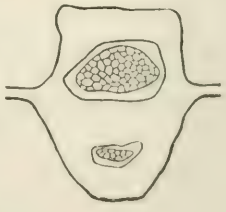

Fig. c.

[1]) When examined in a saturated chloral-hydrate solution.

Resembles superficially *Loxogramma Blumeana* PR

Ceram: Way Sima, in primeval forest, alt. ± 500 m. (L. RUTTEN's Exploration Commission, coll. KORNASSI No. 1373 21 June 1918).

Pleopeltis Feei (BORY) V. A. V. R., Bull. Dép. Agr. I. N. XXVII (1909), 12; Mal. Ferns & All. Supplem. I, 405. — *Polypodium Feei* METT. Farng. I, Polypod., 110; V. A. V. R., Mal. Ferns 675; C. CHR. Ind. Fil. 526. *Selliguea Feei* BORY, Dict. Class. VI, 588; XVII, tab. XLI.

Forma **typica**: Rhizome scales brown or yellow-brown, relatively long and narrow, acutely long-acuminate, resembling those of *Pl. rupestris* MOORE. Fronds not hastate.

Forma **hastifolia**: Rhizome scales ochraceous, relatively short and broad, acute or subacuminate, resembling those of *Pl. triquetra* V A. V. R. Fronds not rarely hastato-3-fid; basal segments subsimilar to the central one but much smaller, with the sori consequently shorter. United with the type by intermediates.

Bali Island: Kintamani, in shady narrow hollow road, alt. 1440 m. (J. VERMEULEN No. 2, 4 June 1921).

Polypodium diplosorum CHRIST in Verh. Nat. Ges. Basel, 11, 440; V. A. V. R., Mal. Ferns, 586.— *Grammitis hirta* BL. Flor. Jav. II, 111, tab. XLVII, fig. 1.

The specimen on which CHRIST based this name is unknown to me but the specimens occurring up till now under this name in the Buitenzorg Herbarium are but narrow forms of *P. sumatranum* BK.; the specimens formerly gathered and determined by RACIBORSKI as *P. subpleiosorum* RAC. are represented by both broad and narrow forms; the broader ones agree exactly with the original *P. sumatranum* BK. (BECCARI No. 448) and the narrower ones with the specimens of *P. diplosorum* quoted.

Polypodium revolvens V. A. V. R., this Bull., II (1920), 170.

BÜNNEMEIJER's No. 6732 from Lingga (Mt. Daik) differs from the Bangka plant in having the stipes somewhat longer, with the hairs deciduous, the fronds rather gradually caudate-acuminate, the sori subsuperficial, to 7 on a side, the receptacle rather oblong. — Epiphytical in forest, alt. 600 m.

Polypodium pseudorevolvens V. A. V. R.

Eupolypodium, Pinnata. — A *P. revolvente* V. A. V. R. differt pinnis horizontalibus vel patentissimis, minus rigidis, planis, in sicco non raro reflexis et margine leviter revolutis, pinnis inferioribus (reductis) contiguis

vel subcontiguis, soris remotiusculis, minus numerosis, 1 — 4 utrinque, cavis sororum vix perspicuis, margine non vel parce ferrugineo-setulosis.

Lingga: Mt. Tanda, epiphytical in jungle, alt. 950 m. (H. A. B. BÜNNEMEIJER No. 6902, 21 July 1919, type); Riouw Archipelago: Poeloe Karimon, Mt. Djantan, on stones in forest, alt. 250 m. (H. A. B. BÜNNEMEIJER No. 7880, 7 September 1919).

Polypodium subhamato-pilosum V. A. v. R. — *Davallia Ledermanni* BRAU. in ENGL. Bot. Jahrb., LVI, 123 (not *P. Ledermanni* BRAU., l.c. 184).

Polystichum prolificans V. A. V. R. this Bull., II (1920), 170.

Sori in 1 row on each side, nearer the costa than the margin, or in 2 rows, with the outer row nearer the margin; indusium small, partly deciduous, partly persistent, surpassing the capsules.

Polystichum eriorachis V. A. V. R.

Stipites fasciculati, 75 85 cm. longi, fusci vel pallide fusci, basin versus plus minusve castanei, primum squamosi, postremo plus minusve glabrescentes; squamae 2-formes; squamae minores squamis minoribus rhachidis similes, basi persistente punctiformi; squamae majores ovatae, obscure fuscae, erosae, appressae, basi persistente transverse ruguliformi. Frondes ovato-lanceolatae, 60—80 cm. longae, 25—30 cm. latae, copiose 2-pinnatae, acuminatae; rhachis primum copiose squamosae, postremo plus minusve glabrescens; squamae 3-formes; squamae minores lanuginoso-furfuriformes, pallide brunneae; squamae intermediae lineari-lanceolatae vel subulatae, brunneae, decidue pallide lanuginoso-fimbriatae; squamae majores squamis majoribus stipitis similes sed minores. Pinnae numerosae, superiores approximatae, patentes, inferiores remotae, horizontales, breviter petiolatae; pinnae inframedianae maximae, lineari-lanceolatae, infra medium $2^1/_2$—3 cm. latae, pinnatae, apice sensim acuminato serratae. Pinnulae coriaceae, numerosae, patentes, subtus parce lanuginoso-paleaceae, glabrescentes, approximatae vel subremotae; pinnulae maximae subrhomboideo-oblongae, usque 2 cm. longae, 6 mm. latae, crenatae vel serrato-crenatae, apice aristato-apiculatae, basi inferiore anguste cuneatae, basi superiore late cuneatae, plus minusve auriculatae, auricula obtusa, interdum mucronulata; venae subdistinctae, non raro plus minusve absconditae. Sori costam approximatae; indusium parvum, peltatum, erosum, deciduum.

Sumatra: Mt. Koerintji, in forest, alt. 2500—2800 m. (H. A. B. BÜNNEMEIJER Nos. 9833, 10386, 29 April — 9 May 1920).

Polystichum flaccidum V. A. V. R.

Stipites fasciculati, 50 - 75 cm. longi, in sicco straminei vel pallide brunnei, copiose squamosi, squamae minores et intermediae iis rhachidis

similes, basi persistente punctiformi; squamae majores ovatae vel lanceolatae, minute eroso-denticulatae, basi persistente oblique vel transverse ruguliformi, inferiores crebrae, castaneae, anguste ferrugineo-marginatae, superiores sensim remotae et ferrugineae vel pallide fuscae. Frondes lanceolato-oblongae, 75—90 cm. longae, 30—35 cm. latae, copiose 2-pinnatae, acuminatae; rhachides primum dense, postremo minus dense squamosae; squamae ferrugineae vel brunneae, minores subrotundae vel lanceolatae, eroso-ciliolatae, majores lineari-subulatae copiose ciliatae vel dilacerato-fimbriatae. Pinnae numerosae, contiguae vel plus minusve remotae, subsessiles, superiores patentes, ceterae horizontales vel inferiores deflexae; pinnae inframedianae maximae, lineari-lanceolatae, basi truncata, ± $2^1/_2$—$3^1/_2$ cm. latae, pinnatae, apice sensim acuminato serratae. Pinnulae subcoriaceae vel firmiter herbaceae, supra glabrae, subtus parce ferrugineo-paleaceo-pilosae, glabrescentes, subhorizontales, subrhomboideo-elongatae; pinnulae anticae infimae maximae, usque $1^3/_4$ cm. longae, basi 6 mm. latae, crenatae vel plus minusve distincte lobatae, apice saepe aristato-apiculatae, basi antica late cuneatae, subauriculatae, basi postica anguste cuneatae; lobuli (crenae) saepe aristatae; auricula obtusa, interdum submucronulata; venae distinctae. Sori costam approximati; indusium parvum, peltatum, deciduum.

Sumatra: Mt. Koerintji, in forest, alt. 2300—2400 m. (H. A. B. BÜNNEMEIJER Nos. 9979, 10297, 10461, 2—10 May 1920).

Polystichum dendrophilum V. A. V. R.

Stipites 35—50 cm. longi, pallide brunnei, squamosi et lanuginoso-villosi, demum basibus persistentibus squamarum pilorumque asperuli et minutissime puncticulati; squamae patentes, ovato-lanceolatae, ochraceo-brunneae vel pallide fuscae, primum copiose fimbriato-laceratae, demum erosae, basi persistenti breviter ruguliformi; pili pro ratione longi, crispati, intricati, laniformes. Frondes 75—100 cm. longae, acuminatae, copiose 3-pinnatae; rhachides lanuginosae, pilis iis stipitis similibus, squamulis similiter coloratis, filiformibus vel subulatis, ciliatis intermixtis. Pinnae numerosae, confertae, patentes, subsessiles vel breviter petiolulatae, e basi lata lineari-lanceolatae, apicem versus sensim serratae, graciliter longe acuminatae, maximae, 20—$27^1/_2$ cm. longae, 4—6 cm. latae. Pinnulae numerosae, approximatae, patentes, breviter petiolulatae, rhomboideo-oblongae, infimae anticae maximae, usque $3^1/_2$—5 cm. longae, 1—$1^1/_2$ cm. latae, infra apicem acute apiculatum, dentatum ad lobatum pinnatae; rhachis in parte superiore anguste alata, subtus parce crispato-pilosa. Segmenta (dentes, lobi vel foliola) in pinnulis maximis usque 10 utrinque, tenuiter coriacea, potius firmiter herbacea, glabra, superiora confluentia, sequentia decurrentia, inferiora basi oblique cuneata sessilia; foliola infima antica maxima, breviter petiolulata, subrhomboidea, usque $7^1/_2$—$17^1/_2$ mm. longa, 3—5 mm. lata, apice obtuso vel apiculato dentata, parte inferiore lobata. Segmenta ultima (dentes, lobi) usque 4 utrinque, obliqua; dentes incurvati, acuti; lobi obtusi vel mucronato-

apiculati; lobi infimi antici maximi, subauriculiformes; venae in segmentis ultimis solitariae, subtus parce crispato-pilosae, glabrescentes, superiores simplices, sequentes furcatae; venae infimae anticae parce pinnatae. Sori inter costam marginemque mediani, relative magni, ad venulas anticas venarum ramosarum terminales; indusium parvum, peltatum, brunneum, obsolete eroso-denticulatum.

Ternate: Foramadiahi, on trunks of trees in forest, alt. 700 m. (V. M. A BEGUIN No. 1096, 12 November 1920); North Foramadiahi, in forest, alt. 1250 m. (V. M. A. BEGUIN No. 1491, 9 March 1921).

Pteris orientalis V. A. V. R., Bull. Dép. Agr. I. N. XVIII (1908), 12.—var. *glabra* V. A. V. R., Bull. Btz. VII (1912), 26; Mal. Ferns. 355; Supplem. I, 247.

Stipe and rhachis varying from pale-reddish-brown to purple or castaneous. Pinnae to 30 cm. long, at length glabrescent, with the base broadly rounded to truncate or cordate.

Forma **typica**. Also in Ternate: Tabahawa, in forest garden, alt. 250 m. (V. M. A. BEGUIN No. 999, 19 October 1920).

Var. **glabra**: Surfaces naked, even when young.

Pteris pellucida PR., Rel. Haenk., I, 55; v. A. v. R., Mal. Ferns, 357; Supplem. I, 247.

BÜNNEMEIJER's Nos. 8496, 9741 from Sumatra (Mt. Koerintji) have some of the fronds with the 2 lower pair of pinnae either forked or semipinnatifid with 2 — 3 remote segments on the posterior side.

Pteris melanocaulon FÉE, Gen. Fil., 5e Mém., 127; v. A. v. R., Mal. Ferns, 358.

Also in Ternate: Fitoe, in ravine, alt. 2 m. (V. M. A. BEGUIN No. 1059, 29 October 1920).

Pteris longipes DON, Prod. Fl. Nep., 15; V. A. V. R., Mal. Ferns, 369.— *Pt. Zollingeri* METT. in MIQ. Ann. Mus. Bot. L. B., IV, 97.— *Pt. radicans* CHRIST var. *javanica* V. A. V. R., Bull. Btz. VII. (1912), 27.— *Pt. pellucens* AG. Rec., 43.

The specimens from Java, Sumatra, Ceylon, British India, Assam, Luzon, Mindanao and Alabat Island, occuring in the Buitenzorg Herbarium, represent so many forms that this species is either very variable or it is a collective species and may be spliced into several distinct species. Our specimens are distinguished as follows: Stipes stramineous or brown to fuscous; rhachises naked or shortly deciduously fibrillose, smooth or at length puncticulate-asperulous by the persistent bases of fallen fibrils; pinnulae adherent or articulated to the rhachis; costae above spinulose, beneath

naked or shortly fibrillose-puberulous; costulae above whether or not spinulose; ultimate segments subentire or sparingly denticulate (*Pt. Zollingeri* METT.) to distinctly toothed or coarsely serrate (*Pt. pellucens* AG.); sori whether or not reaching the base of the ultimate segments, not reaching their apex.

Pteris radicans CHRIST in Ann. Btz., XV, 110; V. A. V. R., Mal. Ferns, 369; Supplem. I, 250.

TEYSMANN's No. 13737 from Celebes (Bonthain, Boeakang) is the only specimen occurring in the Buitenzorg Herbarium, referrible to this species and recognizable in having the primary branches gemmiferous below the apex. In all other respects it resembles too much *Pt. longipes* DON, to which species my var. *javanica* (Bull. Btz. VII (1912), 27) should be referred.

Pteris Wallichiana AGARDH, Rec. Spec., 69; V.A.V.R., Mal. Ferns, 372.

The typical form of this species is described by different authors as having a very smooth stipe and naked fronds; the few specimens of the Buitenzorg Herbarium, as far as still provided with a stipe, fit the descriptions of those authors. The specimens quoted have the fronds more or less copiously pedately divided with 5—9 (rarely to 11) pinnae (i. e. primary and secondary branches); ultimate segments entire to crenate or serrate.

Var. **matoniiformis**: Planta magna. Stipites usque 200 cm. longi vel forsitan longiores, in juventute probabiliter plus minusve copiose, longe rufo-fibrillosi, parte basali squamosi, inter squamas puncticulato-asperuli; squamae firmae sed mox erosae vel dilaceratae et plus minusve deciduae, basibus persistentibus, conspicue tuberculiformibus. Frondes usque 75 cm. longae vel longiores, copiose pedato-divisae, pinnis (ramis primariis secundariisque) 11—15; rhachides parti apicali stipitis similes. Pinnulae numerosae, subcoriaceae, flaccidae; costae, costulae venaeque subtus primum fibrillosae; fibrillae pro ratione longae, appressae, rufae, deciduae. Sori capsulis paraphysibus numerosis, longe fibrilliformibus, primum flavidis, postremo rufis intermixtis.

Sumatra: Mt. Koerintji, water side in forest, alt. 2020 m. (H. A. B. BÜNNEMEIJER No. 9630, 19 April 1920).

C. A. BACKER's No. 9638 from Java (Mt. Gilap, alt. 2000 m.) resembles this variety very much; the stipe of the specimen, however, is wanting in the Herbarium.

Schizoloma Walkerae (HK.) KUHN, Chaetopt., 346; V. A. V. R., Mal. Ferns, 278.— *Lindsaya Walkerae* HK., Spec. Fil. I, 209, tab. LXIX *A*.

The specimens occurring in the Buitenzorg Herbarium have to pinnae with the veins very distinct, stout, when dry not rarely very prominent on both sides.

Also in Lingga: Pasir Pandjang, in a trench, alt. 40 m. (H. A. B. BÜNNEMEIJER No. 6992*a*, 25 July 1919).

Schizoloma Stortii V. A. v. R., Bull. Btz., XVI (1914), 36; Mal. Ferns & All., Supplem. I, 214. Veins erecto-patent, fine, hardly prominent.

Schizoloma auriculatum V. A. v. R. — *Sch. divergens* KUHN var. *auriculata* V. A. v. R., Mal. Ferns, 278. — *Lindsaya divergens* WALL. forma *auriculata* CHRIST, MS. in Herb. Bog.

Isoloma. — Rhizoma breviter repens, castaneo-fibrillosum. Stipites approximati, nigricantes, nitentes, 5 — 15 cm. longi, deorsum subteretes (antice anguste applanati, postice rotundati), sursum (cum rhachide) antice 2-marginati, postice carinati. Frondes elongatae, 10 — 20 cm. longae, medio $2^1/_2$ — 4 cm. latae, pinnatae, apice obtusae vel obtusiusculae, basi paullo angustatae. Pinnae herbaceae ad subcoriaceae, glabrae, infra pinnam terminalem usque ± 25 utrinque; pinna terminalis oblonga, integerrima vel incisa, basi cuneata; pinnae laterales spurie petiolulatae, medianae maximae, subhorizontales, approximatae, elongato-rhomboideo-oblongae, $1^1/_4$ — 2 cm. longae, basi 4 — 6 mm. latae, rectae vel saepius subfalcatae, apice obtusae vel rotundatae, margine sterili saepe crenatae vel lobulato-crenatae, lobulis vel crenis integerrimis crenulatisve, margine fertili integerrimae, basi oblique cuneatae, steriles, imo breviter petioluliformi-angustatae, basi antica late et breviter cuneatae, saepe plus minusve distincte, acutiuscule vel obtusiuscule auriculatae, basi postica anguste et sublongissime cuneatae; pinnae superiores sensim minores at magis ascendentes; pinnae inferiores sat remotae, deflexae, paullo abbreviatae; venae plerumque duplicato furcatae. Sori margines apicemque pinnarum occupantes, plerumque continui, raro hic illic interrupti.

Sch. divergens KUHN differs in having the rhachis and upper part of the stipe not keeled on the back, the pinnae with the upper base truncate, the lower base very shortly and broadly rounded or rotundate-cuneate. — Young fructiferous plants much smaller, with the pinnae resembling somewhat those of *Sch. ovatum* COPEL.

Borneo: Mt. Klam (HALLIER No. 2365 p.p.); Lingga: Mt. Daik and Mt. Tanda, in forest, alt. 250 — 500 m. (H. A. B. BÜNNEMEIJER Nos 6624, 6734, 6903, 12 — 21 July 1919).

Schizoloma ensifolium (SW.) J. SM. in Journ. of Bot. III, 414; V. A. v. R., Mal. Ferns, 280. — *Lindsaya ensifolia* SW. in SCHRAD. Journ., 1800[2], 77.

Pinnae herbaceous, thin or firm, when barren more or less serrulate or crenate-serrulate, sometimes slightly toothed, not rarely entire; veins fine, when dry slightly prominent, visible. — BÜNNEMEIJER's No. 7204a from Poeloe Singkep (Lingga Archipelago) is a specimen with fructiferous simple fronds (forma simplex).

Schizoloma coriaceum V. A. v. R. in Bull. Dép. Agr. I. N. XVIII (1908), 10; Mal. Ferns, 280.

Pinnae coriaceous, when dry with the veins hidden, not prominent, invisible except when seen towards the light.

Stenosemia aurita (SW.) PR., Tent. Pterid., 237; V. A. V. R., Mal. Ferns, 726.— *Acrostichum auritum* SW. in SCHRAD. Journ. 1800², 12.

Var. **reducta**: Varietas dimensionibus minoribus. Segmenta lateralia lobis posticis infimis non vel vix productis, quam sequentibus saepe brevioribus, integerrimis vel maxime crenatis, haud pinnatifidis.

Sumatra: Deli, Lau-Rakit, in entrance of lime-stone grotto, alt. 300 m. (J. A. LÖRZING No. 6354, 1 April 1919).

Syngramma alismifolia (PR.) J. SM. in Lond. Journ. of Bot. IV, 166; V. A. V. R., Mal. Ferns, 543.— *Diplazium alismaefolium* PR., Rel. HAENK. I, 49, tab. 7—8, fig. B.

Var. **Wallichii** (HK.) V. A. V. R., l. c.— *Gymnogramma Wallichii* HK., Spec. Fil. V, 155, tab. CCCII.

Also in Java: Buitenzorg, Tegallega (R. C. BAKHUIZEN VAN DEN BRINK, No. 3792, 4 July 1920).

Lingga Archipelago: Poeloe Singkep, near Manggoe, in forest, alt. 60 m. (H. A. B. BÜNNEMEIJER No. 7204, 2 August 1919, approaches the type); Boekit Tjikaloe, in forest, alt. 60 m. (H. A. B. BÜNNEMEIJER No. 7349, 7 August 1919).

Trichomanes piliferum V. A. V. R.

Eutrichomanes, Gonocormus. — Rhizoma repens, filiforme, ramosum, intricatum, caespitosum, cum stipitibus pilis patentibus, deciduis, pro ratione longis, flavido-brunneis, crispatulis, gracilibus munitum. Stipites graciliter filiformes, ± $1\frac{1}{2} - 2\frac{1}{2}$ cm. longi. Frondes tenuiter membraceae, glabrae, smaragdinae, oblongae vel ovatae, ± 2—4 cm. longae, 1—2 cm. latae; rhachis late alata, cum costis costulisque rubro-brunnea. Pinnae ± 3—5 utrinque, ascendentes vel inferiores patentes; pinnae inferiores pinnatim vel dichotome incisae, superiores simplices vel furcatae. Segmenta ultima oblonga vel breviter linearia, usque 1 cm. longa, 2 mm. lata, margine integerrima vel obsolete denticulata, setulis erectis, acutis, breviter aciculatibus, rubro-brunneis remote ciliata, apice rotundata vel emarginata; costulae in segmentis ultimis solitariae. Sori ad segmenta ultima terminales, non copiosi; indusium elongato-obconoideum, immersum, apice primum truncatum, ciliatum, demum 2-valve, valvis liberis, erectis, rotundatis.

Resembles in aspect a decompound form of *T. digitatum* SW. — The description is taken from fresh material.

Java: Buitenzorg, Mt. Salak, epiphytical in forest, alt. 1800 m. (R. C. BAKHUIZEN VAN DEN BRINK No. 4116, 7 November 1920).

Trichomanes Rothertii V. A. V. R., Bull. Btz. I (1911), 13; Mal. Ferns Supplem. I, 105.

Also in Sumatra: Mt. Koerintji, a single specimen found on the rhizome of *Pleopeltis insignis* BEDD. (H. A. B. BÜNNEMEYER No. 9040, alt. 1500 m.).

Trichomanes sumatranum V. A. V. R., Bull. Dép. Agr. N. I XVIII (1908), 4; Mal. Ferns, 800.

Forma **stipitulatum**: Pinnae fertiles non-contractae soris haud sessilibus sed longiuscule stipitulatis.

Java: Mt. Wiroe near Buitenzorg, on stones in bed of Pangkoelawan River, alt. 750 m. (R. C. BAKHUIZEN VAN DEN BRINK No. 5231, 17 June 1921).

Trichomanes paniculatum V. A. V. R., Bull. Btz. XVI (1914), 38; Mal. Ferns & All., Supplem. I, 111.

Also in Sumatra: Deli, Lau-Rakit, epiphytical in forest, alt. 300 m. (J. A. LÖRZING No. 6361, 1 April 1919).

Trichomanes aphlebioides CHRIST in C. CHR., Ind. Fil., 635; V. A. V. R., Mal. Ferns, 102. – *T. tenuissimum* CHRIST in SCHUM. & LAUT. Flor. deut. Schgeb., 106.

Also in Ternate: Foramadiahi, scandent in forest, alt. 650 m. (V. M. A. BEGUIN No. 1351, 17 January 1921).

Vittaria ensiformis SW., Ges. Nat. Fr. Berl. Neu. Schr. II, 134, tab. VII, fig. 1; V. A. V. R., Mal. Ferns, 555.

Forma **typica**. — Also in Luzon: Mt. Banajao, in forest (EM. WEISS No. 3767, 28 January 1870).

Specimens from Amboina (BOERLAGE No. 662, July 1900), Bangka (Toboali, in forest, alt. 250 m., H. A. B. BÜNNEMEIJER No. 2340, 9 December 1917), Java (Mt. Bongkok, SCHEFFER, 4 September 1870) and Luzon (Los Baños, Mt. Maquiling, A. D. E. ELMER No. 17680 p. p., June—July 1917) are intermediate between the type and var. *dilatata*, with the fronds varying from 6 to 10 mm. broad.

A young plant from Ternate: Tabahawa, on palm-trees in a forest garden, alt. 250 m., V. M. A. BEGUIN No. 996, 19 October 1920), which may be a variety of this species, is distinguished as follows:

Var. **substipitata**: Frondes lineari-oblanceolatae, dimidia parte superiore latissima, apicem acutum vel acutiusculum et basin conspicue angustatam, substipitiformem versus sensim angustata; sori interrupti.

Var. **dilatata**: Frondes lineari-lanceolatae, 1—1½ cm. latae, infra medium latissimae; venae supra prominentes.

Sumatra (FORBES No. 2986a).

HETEROSPORE FILICALES.

Isospore Lycopodiales.

Lycopodium multifarium V. A. V. R.

Urostachys, Euselago. — Caules penduli, usque 50 cm. longi, 2—4-dichotomi, ramis primariis foliis inclusis ± 18 mm. et ramulis ultimis usque ± 10 mm. diametientibus. Folia uniformia vel superiora basi paulo dilatata,

pro ratione crassa sed flaccida, conferta, 12 — 16-faria (alternatim 6 — 8-faria), lineari-subulata, decurrentia, inferiora deflexa, ramorum principalium horizontalia, ramulorum ultimorum sensim ascendentia; folia maxima ± 7 — 8 mm. longa, basi $1/2$ — $3/4$ mm. lata, integerrima, acuta, costa subtus leviter prominens; folia ramulorum sensim minora. Sporangia in axillis foliorum ramorum ultimorum et penultimorum.

Ternate: Foramadiahi, epiphytical in forest, alt. 650 m. (V. M. A. BEGUIN No. 1329, 15 January 1921).

Lycopodium transiens V. A. V. R.

Urostachys. Subselago. — Caules penduli, 20 — 30 cm vel plus longi, dichotome ramosi, ramis foliis inclusis usque 2 cm. diametientibus. Folia ascendentia vel patentia, perlaxa, alternatim 3-faria, tenuia vel flaccida, acuta, costa indistincta vel hic illic subdistincta et in sicco subtus basin versus carina decurrente munita; folia maxima lanceolato-subulata, ± $12 1/2$ mm. longa, supra basin paullo angustatam, decurrentem 1 mm. lata; folia superiora in sporophylla inferiora sensim transientia, lineari-subulata, ad basin rotundatam latissima. Sporophylla laxa, inferiora foliis superioribus similia, usque 10 mm longa, sequentia basi paullo dilatata, longe acuminata, plus minusve carinata.

The description is taken from two fragmentary specimens of which one is sterile and the other fertile but with the spikes still young and short.

Sumatra: Mt. Koerintji, in forest, alt. 2300 — 2750 m. (H. A. B. BÜNNEMEIJER Nos. 9765, 9852, 28 — 30 April 1920).

Lycopodium verticillatum L. (not L. F.) Supplem., 448; V. A. V. R., Mal. Fern All., 32.

Also in Sumatra: Mt. Koerintji, epiphytical in forest, alt. 1600 m. (H. A. B. BÜNNEMEIJER Nos. 8506, 8707, 5 — 11 March 1920).

Lycopodium cernuum L., Spec. 1566; V. A. V. R., Mal. Fern All. 47 — 48.

Var. **capillaceum** (WILLD.) SPRING, Mon. Lycop., I, 80; V. A. V. R., l.c. — L. *capillaceum* WILLD., MS.: Leaves flaccid, nearly capillary, uncinate-incurved, rather loose, those of the stem and main rhachis rather horizontal.

Var. **capillifolium**: Precedenti affine sed foliis subsigmoideis, patentissimis, saepe subrectis, pro ratione longis.

Ternate: Foramadiahi, in grass-field, alt. ± 1650 m. (V. M. A. BEGUIN No. 1194, 26 November 1920).

Lycopodium complanatum L., Spec. 1567; V. A. V. R., Mal. Fern All., 51.

Var. **angustiramosum** V. A. V. R., Bull. Btz. XXIV (1917), 6; Mal. Ferns & All., Supplem. I, 469: Ventral and dorsal leaves subisomorphous, subdeltoid.

Lycopodium casuarinoides SPRING.

The Buitenzorg Herbarium now possesses several specimens of this species from the Philippines (including a sterile fragment of CUMING's authentic No. 2346), Borneo, Sumatra, Singapore, Malacca (Mt Ophir), Khasia and Assam, which represent the different forms as described and drawn by HOOKER in Icon. Pl. X, tab. CMLXVIII. The ultimate forms, however, are in aspect so different that I am inclined to consider them as distinct, though nearly related species, namely *L. casuarinoides* SPRING (which should be placed in the *Diphasium*-group and not in the *Cernuum*-group, as BAKER and I did), to which my *L. Jacobsonii* must be referred and *L. filicaule* HK F, to which my *L. penicilliferum* must be referred.

Lycopodium casuarinoides SPRING, Mon. Lycop. I, 94; II, 45; var. 1—2, HK., Icon. Pl. X, tab. CMLXVIII, fig. 1—3, 6—7; V. A. V. R., Mal. Fern All., 49.— *L. leucolepis* JUNGH. & DE VR. in Ned. Kruidk. Arch. I, (1848) 13; V. A. V. R., Supplem. I, 468.— *L. Jacobsonii* V. A. V. R. in Bull. Btz. XXIII (1916) 22, tab. III—IV; Supplem. I, l. c.

SPRING says „Folia undique 6-faria, subverticillata . . . .", which does not agree entirely with the arrangement of the leaves of the fragment of CUMING's No 2346 occurring in the Buitenzorg Herbarium. The fragment quoted has a distinctly platystichous arrangement of the leaves agreeing with my description and plate III of *L. Jacobsonii*.

Lycopodium filicaule HK. F., Bot. of Ant. Voy., II, 102.— *L. casuarinoides* SPRING var. *complanatum* SPRING, Mon. Lycop. II, 45.— *L. casuarinoides* SPRING var. 3 HK., Icon. Pl. X, tab. CMLXVIII (descript.). *L. penicilliferum* V. A. V. R. in Bull. Btz. XVI (1914) 40, tab. X.

HOOKER's var. 4 (l. c. fig. 4—5) seems to be a form with rather radiately spreading isomorphous leaves.

Heterospore Lycopodiales.

Selaginella pentaphlebia V. A. V. R.

Heterophyllum, Monostelicae, Radicantes. — Caules probabiliter repentes, apicem versus ascendentes, parte inferiore simpliciter furcati vel irregulariter dichotomi, caulibus secundariis tertiariisque pinnatim ramosis; rhachides principales 2—3 mm. crassae, in sicco obtuse angulosae et leviter sulcatae, pallide flavido-brunneae, foliis lateralibus inclusis 10—12 mm. latae; pinnae remotae, ascendentes, usque 7½ cm. longae, pinnatae; pinnulae erecto-patentes, 1—3 utrinque, simplices, furcatae vel parce subpinnatae; ramuli ultimi 5—25 mm. longi, 4—8 mm. lati. Folia ubique heteromorpha; folia lateralia utrinque cellulis scleroticis plus minusve distincte pellucido-marginata, inter costam marginemque spurie venulosa; lateralia rhachidum principalium subfalcato-ovato-oblonga, inaequilatera, inferiora decidua (fragilia), superiora persistentia, subremota, horizontalia vel subhorizontalia, obtusiuscula vel

acutiuscula, semifacie superiore minute serrulata, basi late rotundata, semifacie inferiore integerrima sed ad basin anguste cordato- vel truncato-rotundatam serrulata, lateralia maxima 5 1/2 mm. longa, 2 1/2 mm. lata; lateralia pinnarum sensim paullo minora; lateralia ramulorum ultimorum approximata, patentia, subfalcato-lineari-oblonga, usque 4 mm. longa, 1 1/2 mm. lata, basi superiore rotundato-cuneata, basi inferiore rotundata, non serrulata; folia intermedia erecta; intermedia rhachidum principalium remota, semicordato-ovato-oblonga, longe cuspidata, anguste pellucido-marginata, minute serrulata, basi interiore rotundata, basi exteriore producta, auriculata, auricula rotundata, leviter hamato-incurvata, intermedia maxima 3 1/2 mm. longa, cuspide fere 2/3 longitudinis laminae metiente; intermedia pinnarum sensim minora; intermedia ramulorum imbricata, basi exteriore non incurvata. Spicae ad ramulos terminales, solitariae vel hic illic 2-nae, 1 3/4 mm. (postremo 2 1/2) mm. crassae; sporophylla ovata, acuta vel breviter acuminata, pellucido-marginata, minute serrulata, carinata, postremo squarrosa; macrosporae 2, eburneae, dense subgraciliter irregulariter verruculoso-rugulosae, parte apicali depresso-convexa, ecostata, cristula annuliformi circumdata; microsporae probabiliter desunt.

Belongs to the affinity of *S. Springiana* V. A. V. R. and *S. Grabowskyi* WARB.

Riouw Archipelago: Poeloe Bintan, Mt. Bintan, in forest, alt. 350 m. (H. A. B. BÜNNEMEIJER No. 6175, 13 June 1919).

Selaginella speluncae V. A. V. R.

Heterophyllum, *Monostelicae*, *Radicantes*. — Caules repentes (caespitosi?), laxe ramosi, rhachide primaria usque 1 mm. crassa, in sicco pallide brunnea, irregulariter sulcata, foliis lateralibus inclusis 7—8 mm. lata; rami paullo remoti, simplices vel furcati aut inferiores medianique plus minusve pinnatim ramosi, usque 5 cm. longi vel longiores et caules separatos formantes; ramuli ultimi usque 2 cm. longi, 5—7 mm. lati. Folia ubique heteromorpha, utrinque cellulis scleroticis anguste pellucido-marginata, integerrima vel ramulorum ultimorum lateralia suprema semifacie superiore persparse et minutissime serrulata; folia lateralia horizontalia vel subhorizontalia, rhachidis primariae approximata vel paullo remota, ramulorum ultimorum approximata vel subcontigua; lateralia rhachidis primariae maxima, late oblonga, usque 4 mm. longa, 2 1/4 mm. lata, apice obtusa, abrupte breviter mucronulato-apiculata, basi superiore rotundato-cuneata, basi inferiore late rotundata vel rotundato-truncata; lateralia ramulorum subsimilia, usque 3 1/2 mm. longa, 1 3/4 mm. lata; folia intermedia erecta vel suberecta, rhachidis primariae remota vel contigua, ramulorum ultimorum contigua vel imbricata; intermedia rhachidis primariae maxima, subfalcato-oblonga, usque 2 1/2 mm. longa, apice acute acuminata, semifacie interiore subrecta, basi angustata, semifacie exteriore rotundata, basi valde producta et cordato-auriculata, auricula non vel leviter hamato-incurvata; intermedia ramulorum subsimilia sed minora, basi exteriore minus producta, rotundata. Spicae

tetragonae, ad ramulos terminales, usque 2 cm. longae et 2 mm. crassae; sporophylla ascendentia, postremo subpatentia, elongato-ovata, apice longe acuta, pellucido-marginata, integerrima vel persparse, minute serrulata; macrosporae in juventute pallide flavidae vel brunneae, demum obscure sordide brunneae; microsporae flavidae, cristis aliformibus, latiusculis, membranaceis, reticulatis munitae.

Forma **typica**: Macrosporae ubique gracillime reticulato-rugulosae.

Sumatra: Lau-Rakit, in entrance of lime-stone grotto, alt. 300 m. (J. A. LÖRZING No. 6352, 1 April 1919).

Var. **effugita**: Macrosporae latere rotundato indistincte verruculosae, gibbis rotundis vel paullo elongatis, a latere apicali annulo aequatoriali, gibbis distinctis, tuberculiformibus, confertis formato separatis.

Sumatra: Lau-Betimoes, on stones and tuff-walls in forest, alt. 450 m. (J. A. LÖRZING No. 6694, 21 June 1919).

Selaginella pseudovenulosa V. A. V. R.

Heterophyllum, Monostelicae, Ascendentes. — Caules e basi breviter repente erecti, usque 50 — 60 cm. alti, fere a basi irregulariter pinnatim ramosi, rhachide primaria subtereti, in sicco pallide fusca, 2 — 3 mm. crassa, antice leviter sulcata, foliis lateralibus inclusis 7 — 9 mm. lata; pinnae erecto-patentes, brevissimae ad longissimae, 4 — 40 cm. longae; pinnulae remotae, 4 — 12 utrinque, erecto-patentes, pinnarum breviorum breves, pinnarum longiorum usque 5 cm. longae, pinnatim ramosae, ramis paucis, remotis, erecto-patentibus, simplicibus vel furcatis; ramuli ultimi 1 — 10 mm. longi, 2 — 3 mm. lati. Folia ubique heteromorpha; folia lateralia oblonga, valde inaequilatera; lateralia caulina plus minusve remota, inferiora caduca, superiora persistentia, horizontalia vel subhorizontalia, obtusiuscula, utrinque cellulis scleroticis plus minusve distincte pellucido-marginata et breviuscule spurie venulosa, semifacie superiore minute serrulata, basi late rotundato- vel cordato-truncata, semifacie integerrima, basi angustata, lateralia maxima 4 mm. longa, 2 mm. lata, venulis spuriis inter costam marginemque medianis, interruptis; lateralia ramulorum ultimorum usque 2 mm. longa, 1 mm. lata, basi superiore rotundato-cuneata; folia intermedia erecta; intermedia caulina remota, subfalcato-ovata, maxima 2 mm. longa, breviter cuspidato-acuminata, plus minusve minute serrulata, apicem versus subcarinata, basi oblique rotundata vel basi exteriore leviter cordato-auriculata; intermedia ramorum sensim minora; intermedia ramulorum subimbricata. Spicae ad ramulos ultimos saepe brevissimos terminales, solitariae vel 2-nae, postremo 2 mm. crassae; sporophylla ovata, acuta vel breviter acuminata, carinata, minute serrulata, postremo squarrosa; macrosporae in macrosporangiis 4, pallide ochraceae, latere rotundato cristato-rugosae, cristis ramosis, subreticulatis, costis apicalibus crista annuliformi cinctis; microsporae . . . . . (microsporangia in specimine effoeta).

Lingga: Mt. Daik, in forest, alt. 250 m. (H. A. B. BÜNNEMEIJER No 6631, 12 July 1919).

Selaginella bimarginata V. A. V. R.

Heterophyllum, Monostelicae, Ascendentes. — Caules e basi probabiliter breviter decumbente erecti, certe 27 $^1/_2$ cm. alti, parte inferiore . . . . , parte superiore ramosi, rhachide primaria in sicco pallide brunnea, + 2$^1/_2$ mm. crassa, subtereti, i.e. indistincte angulosa et sulcata, cum rhachidibus secundariis (foliis lateralibus inclusis) 12—13 mm. lata; pinnae furcatae vel pinnatae et apice interdum furcatae, maximae usque 18 cm. longae; pinnulae pinnarum inferiorum usque 6 utrinque, simpliciter vel duplicato furcatae; ramuli ultimi 1—5 mm. longi, longissimi ad basin 4—5 mm. lati. Folia heteromorpha; folia lateralia rhachidum primariae secundariarumque horizontalia, ramulorum ultimorum patentia; lateralia rhachidis primariae subremota, potius approximata, lineari-oblonga, subaequilatera, utrinque venula spuria submarginali munita, semifacie superiore apicem acutiusculum vel obtusiusculum et falcatulum versus integerrima, ceterum minutissime serrulata, basi rotundata, semifacie inferiore integerrima, basi rotundato-truncata, folia maxima + 6 mm. longa, 2 $^1/_4$ mm. lata; lateralia rhachidum secundariarum similia sed magis approximata, potius contigua; lateralia ramulorum ultimorum contigua, usque 4 mm. longa, 1 mm. lata, basi antica anguste rotundato-cuneata, basi postica cuneato-truncata; folia intermedia erecta; intermedia rhachidum principalium approximata vel contigua, subobovato-oblonga, usque 3 mm. longa, apicem abrupte, breviter cuspidatum versus cellulis scleroticis anguste pellucido-marginata, minutissime serrulata, basin versus integerrima, basi interiore rotundata, basi exteriore valde producta, cordata, auricula late rotundata, leviter hamato-incurvata; intermedia ramulorum imbricata, paullo longius cuspidata, basi exteriore minus producta, auricula recta, cuspide $^1/_4$—$^1/_3$ longitudinis laminae metiente Spicae ad ramulos valde reductos terminales, solitariae vel 2-nae, primum 1 mm., postremo 2 mm. crassae; sporophylla ovata, acuta, minute serrulata, carinata, adulta 1$^1/_2$ mm. longa, patentissima. Macrosporae in sporangiis 2, graciliter reticulato-rugulosa, apice subapplanata, ecostata, crista annuliformi cincta; microsporae probabiliter desunt.

Java: Mt. Tjipoetih near Buitenzorg, in forest (R. C. BAKHUIZEN VAN DEN BRINK f. No. 806, 17 June 1921).

Selaginella spuriemarginata V. A. V. R.

Heterophyllum, Monostelicae, Ascendentes. — Caules erecti, + 30 cm. alti, fere a basi pinnati vel furcati et pinnati, ± 2 mm. crassi, in sicco pallide fusci, postice rotundati, antice sub-2-sulcati, foliis lateralibus inclusis 10—12 mm. lati; pinnae erecto-patentes, pinnatae; pinnulae erecto-patentes, paucae, simplices, furcatae vel parce subpinnatae; ramuli ultimi suberecti, 1—10 mm. longi, 3—5 mm. lati. Folia ubique heteromorpha; folia lateralia vix sigmoideo-lineari-oblonga, subaequilatera, acutiuscula, utrinque venula spuria relative lata, marginali vel submarginali munita; lateralia caulina remotiuscula, horizontalia vel subhorizontalia, inferiora decidua (fragilia), superiora persistentia,

semifacie superiore apicem versus integerrima vel obsoletissime denticulata, ceterum minute serrulata, basi rotundato-cuneata, semifacie inferiore integerrima, basi subcordato-rotundata, lateralia maxima $6^1/_4$ mm. longa, 2 mm. lata; lateralia pinnarum sensim minora; lateralia ramulorum ultimorum approximata, patentia, usque 4 mm. longa, 1 mm. lata, basi anteriore anguste rotundato-cuneata, basi posteriore rotundata; folia intermedia erecta; semicordato-ovata vel -oblonga, longe cuspidata; intermedia caulina remota, semifacie interiore obsolete vel minutissime denticulata, basi subcordato-rotundata, semifacie exteriore integerrima, basi producta, late auriculata, auricula rotundata, distinctius hamato-incurvata, intermedia maxima $3^1/_2 - 3^3/_4$ mm. longa, cuspide fere $^2/_3$ longitudinis laminae metiente; intermedia pinnarum sensim minora; intermedia ramulorum imbricata, semifacie interiore infra cuspidem parcissime minutissimeque serrulata, basi anguste rotundata, semifacie exteriore basi rotundato-auriculata, auricula non incurvata, cuspide $+ ^3/_4$ longitudinis laminae metiente. Spicae in ramulos ultimos terminales vel interdum axillares, solitariae vel raro 2–3-nae, $1^1/_4$ (postremo $2^1/_2$) mm. crassae; sporophylla ovata, acuminata, minute serrulata, carinata; macrosporae in macrosporangiis 2, eburneae vel pallide flavidae, copiose, graciliter subreticulato-rugulosae, apice depresso-convexo, ecostato, rugula gracili, annuliformi cincto; microsporae probabiliter desunt.

Belongs to the affinity of *S. Grabowskyi* WARB.

Lingga Archipelago: Poeloe Singkep, near Dabo, in forest, alt. 40 m. (H. A. B. BÜNNEMEIJER No. 7252, 4 August 1919).

Selaginella ceratocaulos V. A. V. R., Bull. Btz. XVI (1914), 41; Mal. Fern All., 238.

Forma **kangeanensis**: Lower part of the stem and lower leaves not reddish; largest lateral and intermedial leaves more distinctly and more copiously ciliate on both sides at the base, the largest lateral ones more broadly rounded, slightly cordate at the upper base and more broadly rotundate-cuneate at the lower base; lateral leaves of the ultimate branchlets to $2^3/_4$ mm. long; macrospores yellowish-white, pulverulent, glabrescent, at length smooth.

Kangean Island: Mt. Eteng, Tambajangan, on lime-stone rocks, in forest, alt. 200 m. (C. A. BACKER No. 27961, 5 April 1919).

Selaginella palembanica V. A. V. R., Bull. Btz. XXVIII (1918), 48.

Var. **subtrinervia**: Varietas dimensionibus paullo majoribus. Rhachis primaria usque 9 mm. lata; ramuli ultimi usque 5 mm. lati. Folia lateralia venula spuria marginali cincta, omnia (i. e. foliis rhachidis primariae inclusis) utrinque inter costam et venulam spuriam marginalem venula spuria + mediana munita. Microsporae adultae gibbis apice saepe capitato-incrassatis.

Sumatra: Deli, Bandar-baroe, on dry ground at foot of rock in primeval forest, alt. 850 m. (J. A. LÖRZING No. 6868, 7 October 1919).

Selaginella propinqua V. A. V. R.

Heterophyllum, Monostelicae, Caulescentes. — Caules e basi repente erecti, 50—75 cm. alti, parte inferiore stipitiformes, 20—40 cm. longi, parte superiore pinnatim decompositi, oblongi vel flabelliformes, stipite leviter compresso-tereti, in sicco pallide fusco, laevi vel subsulcato, basi 3—4 mm. crasso; rhachis primaria foliis lateralibus inclusis 6—7 mm. lata; pinnae ascendentes, patentes, nutantes vel subsigmoideae, inferiores usque 20 cm. longae et 10 cm. latae; pinnarum inferiorum pinnulae ascendentes, partim relative breves furcataeque, partim longae pinnataeque et ramis simplicibus vel furcatis; ramuli ultimi usque 3 cm. longi, 3—4 mm. lati. Folia stipitis subisomorpha, remota, erecta, breviter oblonga, usque 3 mm. longa, longe acuminata vel cuspidato-acuminata, semifacie interiore late rotundata, copiose minuteque serrulata, basi angustata, semifacie exteriore subrecta, basi rotundata vel leviter auriculata, vix producta; folia partis ramosae heteromorpha; folia lateralia ascendentes, conferta vel approximata; lateralia rhachidis primariae oblonga, subaequilatera, apicem subacutum versus falcata, utrinque latere venula spuria, submarginali munita, semifacie superiore in parte superiore parce obsolete serrulata, in parte inferiore late rotundato-cuneata magis copiose, minute serrulata, semifacie inferiore integerrima vel ad basin abrupte, anguste vel latiuscule cuneatam denticulo 1 munita, folia maxima 5 mm. longa, $2^1/_2$ mm. lata; lateralia ramorum sensim minora et pro ratione multo angustiora; lateralia ramulorum ultimorum subsigmoideo-lanceolata, usque $2^1/_2$ mm. longa et fere 1 mm. lata, utrinque venula spuria, intramarginali, angustissima munita, semifacie superiore basin anguste rotundato-cuneatam versus parce minuteque serrulata; folia intermedia erecta; intermedia rhachidis primariae subremota, ovato- vel obovato-oblonga, cuspidato-acuminata, apicem versus subcarinata, margine plus minusve copiose, minute serrulata, basi interiore anguste rotundata vel rotundato-cuneata, basi exteriore leviter producta, rotundata vel subcordato-auriculata, folia maxima $4^1/_2$ mm. longa, cuspide $^1/_3$ longitudinis laminae metiente; intermedia ramorum sensim minora; intermedia ramulorum ultimorum minutissima, imbricata, integerrima, cellulis scleroticis utrinque late pellucido-marginata, basi utrinque angustius cuneata, cuspide $^1/_2$ longitudinis laminae metiente. Spicae ad ramulos ultimos terminales solitariaeque, postremo ± 2 mm. crassae; sporophylla ovata, sensim acuminata, subcarinata, pellucido-marginata, minute serrulata, postremo squarrosa; sporae non vidi (macro- et microsporangia in specimine effoeta).

Riouw Archipelago: Poeloe Toedjoeh, Si-Oeloe, in forest, alt. 50 m. (H. A. B. BÜNNEMEIJER No. 6042, 23 May 1919).

Selaginella pilosula V. A. V. R.

Heterophyllum, Monostelicae, Pubescentes — Caules e basi repente erecti, ± 15 cm. alti, parte inferiore simplices, stipitiformes, longe flagelligeri, in sicco pallide fusci, cum rhachide primaria minute deciduque pilosuli,

parte superiore ramosi, in circuitu ovati vel rotundato-ovati, + 10 - 12 1/2 cm. longi, 7 1/2—10 cm. lati; pinnae ascendentes, inferiores lineari-lanceolatae, usque 7 1/2 cm. longae; pinnulae contiguae, valde ascendentes, simplices vel furcatae; ramuli ultimi usque 2 cm. longi, foliis lateralibus inclusis 4—5 mm. lati. Folia ubique heteromorpha; folia lateralia caulina patentes, lateralia ramulorum ascendentia; lateralia rhachidis primariae maxima, approximata vel remotiuscula, oblique lanceolato-oblonga, 4 1/2 mm. longa, 2 mm. lata, subacuta, semifacie superiore minute serrulata, basi rotundato-cuneata; semifacie inferiore apicem versus minute serrulata, basi cuneata; lateralia ramulorum subsimilia, contigua, usque 3 mm. longa, 1 mm. lata, obtusiuscula vel obtusa, basi magis angustata; folia intermedia erecta, oblonga vel ovata; intermedia rhachidis primariae maxima, 2 1/2 mm. longa, breviter acuminata, cellulis scleroticis anguste pellucido-marginata, minute serrulata, basi interiore angustata, basi exteriore producta, auriculata, auricula leviter hamato-incurvata; intermedia ramulorum minora, imbricata, basi interiore anguste cuneata, basi exteriore cordato-auriculata. Spicae ad ramulos solitariae terminalesque, usque 1 1/2 cm. vel plus longae, 1 1/2—2 mm. crassae; sporophylla ascendentes, postremo patentes, triangulari-ovatae, acutae, minute serrulatae, leviter carinatae; microsporae pallide aurantiacae, parte basali gibbis stipitato-capitatis ornatae.

The specimens on hand have the macrospores still young and undeveloped but it seems that in age they will be reticulate-rugulose.

Ternate: Foramadiahi, on stones in ravine, alt. ± 350 m. (V. M. A. BEGUIN No. 1213, 9 December 1920).

Selaginella biformis A. BR., MS.; HIERON. in Leafl. VI, 2001; V. A. V. R., Mal. Fern All. 147; Supplem. I, Corr., 62.

A specimen received from the Philippines (Luzon, Angat, M. RAMOS & G. EDANO, Bur. of Sci. No. 34184), has the microspores nearly golden-yellow, provided with stipitate-capitate projections.

Selaginella Hieronymiana V. A. V. R., Bull. Btz. VII (1912), 31; Mal. Fern All., 152.

Also in Batjan (TEYSMANN No. 68); Ternate: Foramadiahi, on rocks in ravine, alt. 500 m. (V. M. A. BEGUIN No. 1292, 10 January 1921); Soelamadaha, on stones in young forest, alt. 15 m. (V. M. A. BEGUIN No. 1378, 8 February 1921). — All specimens sterile but readily recognizable.

Selaginella petrophila V. A. V. R.

Heterophyllum, *Monostelicae*, *Intertextae*. — Caules repentes, spicis exclusis usque 8 cm. longi, laxe pinnatim ramosi, rhachide primaria 1/2—3/4 mm. crassa, in sicco straminea, foliis lateralibus inclusis + 4 1/2 mm. lata; rami remoti, breves, superiores simplices vel furcati, inferiores furcati vel parce pinnati, spicis exclusis usque 2 cm. longi; ramuli ultimi usque 5 mm.

longi, $1^1/_2$—3 (hic illic usque 4) mm. lati. Folia ubique heteromorpha; folia lateralia patentissima (subhorizontalia) contigua vel approximata vel ramulorum ultimorum hic illic imbricata; lateralia rhachidis primariae maxima, oblique oblonga, + 2 mm. longa, $1^1/_4$ mm. lata, obtusiuscula vel acutiuscula, utrinque copiose, minute serrulata, basi superiore late rotundata vel subcordato-rotundata, basi inferiore anguste rotundata; lateralia ramulorum similia sed minora, usque $1^1/_2$ mm. longa; folia intermedia erecta, paullo remota vel approximata vel ramulorum ultimorum hic illic imbricata; intermedia rhachidis primariae maxima, ovata, + 1 mm. longa, breviter cuspidato-acuminata, minute serrulata, basi leviter oblique, late rotundata; intermedia ramulorum similia sed minora. Spicae ad ramulos terminales vel interdum in axillis ramulorum furcatorum, simplices vel interdum furcatae, brevissimae vel usque 3 cm. longae, 2 mm. latae; sporophylla lateralia patentia, conferta, oblique, late oblonga, acuta vel subacuta, minute serrulata, carinata; sporophylla intermedia erecta, imbricata, ovata, acuminata, carinata; sporae non vidi.

Sumatra: Deli, Sibolangit, on rocks in forest, alt. 1400 m. (J. A. LÖRZING No. 7254, 20 February 1920).

Selaginella subspinulosa SPRING in Pl. JUNGH., 277; V. A. V. R., Mal. Fern All. 169.

A specimen gathered by W. DOCTERS VAN LEEUWEN (Java, Bandoeng, Dago Water-fall, No. 2568) differs from ZOLLINGER's original No. 2011 in having the dimensions of the leaves a little larger. Lateral leaves roundish-oblong to oblong, $^1/_3$—$^1/_2$ as broad as long, bluntish to rounded at the apex, the base rounded, the upper edge remotely ciliate, obsoletely or very minutely serrulate towards the apex, as is the lower edge; intermedial leaves acuminate, ciliate on both sides, those of the main rhachis broadly ovate-oblong, of the ultimate branchlets proportionally narrower.

Selaginella pcynocarpa V. A. V. R., Bull. Btz. XXIII (1916), 25; Mal. Fern. & All., Supplem. I, 477.

Both macrospores and microspores apparently smooth, pale-yellow, the former nearly white, pulverulent when young.

Also in Java: Buitenzorg, Mt. Tjipoetih, along rivers in forest, alt. 600 m. (R. C. BAKHUIZEN VAN DEN BRINK No. 4187, 24 September 1920); Mt. Wiroe, on stones and trunk of tree ferns in forest, alt. 750 m. (R. C. BAKHUIZEN VAN DEN BRINK No 5213, 17 June 1921).

Selaginella papana V. A. V. R.

Heterophyllum, Monostelicae, Suberosae. — Caules parvi, caespitosi, ascendentes, in circuitu oblongi ad flabellati, usque 4 cm. longi et 8 cm lati, copiose radicantes, a basi pinnatim decompositi, rhachide primaria in sicco straminea, $\pm$ $^1/_2$ mm. crassa, foliis lateralibus inclusis 3 — $3^1/_2$ mm. lata; pinnae usque + 5 utrinque, superiores erecto-patentes, parce simpliciter

pinnatae, inferiores patentes vel horizontales, pinnatim decompositae; ramuli ultimi brevissimi, usque 4 mm. longi, 2—2½ mm. lati, utrinque 1—4-foliati. Folia tenuiter herbacea, ubique heteromorpha, cellulis scleroticis anguste pellucido-marginata; folia lateralia rhachidis primariae subremota, horizontalia vel subhorizontalia, oblonga, usque 2½ mm. longa, ± 1 mm. lata, acuta vel acutiuscula, semifacie superiore in parte superiore obsolete denticulata, in parte inferiore remote, minute serrulata, basi late rotundata parce breviter subspinuloso-ciliolata, semifacie inferiore obsolete denticulata, basi anguste rotundata; lateralia ramulorum ultimorum approximata, leviter ascendentia, fere 2 mm. longa et 1 mm. lata, basi superiore angustiora, rotundato-cuneata; folia intermedia erecta; intermedia rhachidis primariae conferta, ovata, usque fere 2 mm. longa, subacuminata, remote et obsolete vel minutissime serrulata, basi leviter oblique rotundata; intermedia ramulorum imbricata, paullo breviora sed distinctius acuminata. Spicae numerosae, ad ramulos ultimos terminales, solitariae, usque 1 cm. longae vel probabiliter longiores, 3 mm. latae; sporophylla anguste pellucido-marginata; lateralia subhorizontalia, lanceolato-oblonga, acuta, remote et obsolete vel minute serrulata, carinata; intermedia suberecta, imbricata, quam lateralia vix breviora, ovata, acuminata, remote, breviter spinuloso-ciliolata, subcarinata; macrosporae eburneae vel citrinae, copiose irregulariter graciliter subreticulato-rugulosae; microsporae. . . . .

In the very numerous spikes I found only macrosporangia. — By the habit as well referrible to the *Intertextae*.

Riouw Archipelago: Poeloe Papan, on trunk of tree in forest, alt. 15 m. (H. A. B. BÜNNEMEIJER No. 7818, 6 September 1919).

Selaginella modica V. A. V. R.

Heterophyllum, *Monostelicae*, *Suberosae*. — Caules e basi breviter decumbente ascendentes vel erecti, 10—20 cm. longi, usque vel fere usque ad basin pinnatim ramosi, usque ad medium radicantes, usque 1 mm. crassi, in sicco straminei et sulcati vel angulosi, foliis lateralibus inclusis ± 7 mm. lati; pinnae superiores per breves, simplices vel furcatae, inferiores 2-pinnatae, majores usque 10 cm. longae; ramuli ultimi maxime ½ cm. longi, 2½—3 mm. lati. Folia ubique heteromorpha; folia lateralia ubique remota, patentia; lateralia caulina oblonga, usque 4 mm. longa et 2 mm. lata, apicem obtusiusculum versus obsolete vel minutissime serrulata, semifacie superiore basin late rotundato-subcordatam versus sensim ciliolata, semifacie inferiore basin truncato-rotundatam vel -subcordatam versus integerrima; lateralia ramulorum minora, usque 2 mm. longa; folia intermedia erecta; intermedia caulina remota, late ovata, ± 1½—1¾ mm. longa, apicem subabrupte acuminatum versus minutissime serrulata, semifacie interiore basin versus sensim ciliolata, basi semicordata, auricula rotundata, semifacie exteriore basi plus minusve producta, adnata, rotundata, integerrima, intermedia ramulorum imbricata, basi interiore rotundata vel late rotundato-cuneata, basi exteriore decurrenti cuneata. Spicae copiosae, solitariae (saepe

specie 2-nae), ad ramulos terminales, usque ± 7 mm. longae, 2 ½—3 mm. latae; sporophylla lateralia conferta, vix imbricata, patentia, oblonga, leviter recurvata, apicem obtusiusculum versus obsolete vel minutissime serrulata, carinata, semifacie superiore cum carina basin versus minute serrulata; sporophylla intermedia suberecta, triangulari-ovata, apicem acuminatum versus minute serrulata, basin versus sensim ciliolata; macrosporae perpallide flavidae, subalbae, laeves, in juventute pulverulentes; microsporae aurantiacae, copiose, minutissime verruculosae.

Java: Besoeki, Mt. Kendeng, forest-path, alt. 1100 m. (C. A. BACKER No. 30731, 18 April 1920).

Selaginella varians V. A. v. R.

Heterophyllum, Monostelicae, Suberosae. — Caules e basi breviter decumbente erecti, 15—35 cm. alti, pinnatim ramosi, plus minusve crassi, spongiosi, in sicco pallide brunnei, irregulariter sulcati vel angulosi, foliis lateralibus inclusis usque ± 4 mm. lati; pinnae pinnatae, pinnulis superioribus simplicibus, ceteris furcatis vel parce pinnatis; ramuli ultimi brevissimi, spicis exclusis 1—2 mm. longi, ± 1 mm. lati. Folia crassa, heteromorpha; folia lateralia valde ascendentia; lateralia caulina remota, breviter et late oblonga, in sicco apicem versus involuta, usque 2 mm. longa, 1 mm. lata, valde inaequilatera, obtusa vel obtusiuscula, semifacie superiore minute serrulata, basi late rotundata, semifacie inferiore integerrima vel obsolete serrulata, basi angustata; lateralia ramulorum similia sed multo minora, imbricata; folia intermedia erecta; intermedia caulina remota, ad apices callorum longitudinalium, latorum, planorum posita, ovata, + 1 ½ mm. longa, acuminata, minute serrulata, basi aequilatera; intermedia ramulorum similia sed multo minora, imbricata. Spicae ad apices ramulorum solitariae, ½—1 cm. longae, 1 ¼ mm. latae; sporophylla lateralia patentia, breviter late oblique oblonga, quam intermedia vix longiora, obtusiuscula vel acutiuscula, minute serrulata; sporophylla intermedia suberecta, ovata, acuminata, minute serrulata, carinata; macrosporae pallide flavidae, decidue verruculosae, postremo laeves; microsporae pallide aurantiacae vel aurantiaco-flavidae, dense verrucosae.

Form **typica**. — Sumatra: Deli, Sibolangit, sunny hill side, alt. 400 m. (J. A. LÖRZING No. 6312*a*, 30 January 1919).

Forma **sciaphila**: Caules 6—8 cm. lati; ramuli ultimi 2 mm. lati. Folia tenuia; folia lateralia caulina approximata ad remota, subhorizontalia, plana, usque 4 mm. longa, 1 ½ mm. lata, minus inaequilatera, basi superiore minus late rotundata; folia intermedia caulina ad apices callorum angustiorum, minus planorum. Spicae 1—2 cm. longae, 2 mm. latae, sporophyllis lateralibus quam intermediis multo longioribus.

Sumatra: Deli, Sibolangit, on slightly shaded tuff-walls or on large stones in primeval forest, alt. 400 m. (J. A. LÖRZING Nos. 6312*b-c*, 30 January 1919).

Selaginella aristata SPRING, Mon. Lycop. II, 245; V. A. V. R., Mal. Fern All., 191.

Var. **Kaudernii**: A forma typica differt caulibus paullo robustioribus, foliis lateralibus minus remotis, subapproximatis, subintegerrimis, hic illic valde obsolete serrulatis, obtusioribus, macrosporis minutissime, decidue puncticulato-verruculosis.

Celebes: Goeroepahi, open ground in rain-forest, alt. 600 m. (W. KAUDERN No. 7, 18 March 1917).

Selaginella verruculosa V. A. V. R.

Heterophyllum, Pleiostelicae. — Caules e basi repente erecti, usque 40 — 50 cm. alti, copiose verruculosi, parte inferiore simplices, stipitiformes, 3-stelici, foliati, in sicco irregulariter sulcati, pallide brunnei, parte superiore pinnatim ramosi, usque 25 cm. vel plus longi; pinnae ascendentes, linearilanceolatae, usque $17^1/_2$ cm. vel plus longae, copiose pinnatae; pinnulae contiguae, ascendentes, usque 2 cm. longae, 3 — 5 mm. latae, terminales non raro caudato-elongatae. Folia integerrima; folia caulina subisomorpha, remota, erecta, falcato-oblonga, acuta; caulina lateralia basi interiore deflexo-calcarata, basi exteriore auriculata; calcar foliorum superiorum breve integerrimumque, foliorum inferiorum elongatum eroso-denticulatumque; auricula conspicue hamato-incurvata, eroso-denticulata; caulina intermedia basi 2-auriculata, auriculis conspicue hamato-incurvatis, imbricatis; folia ramorum heteromorpha; folia axillaria rhachidis primariae basi 2-auriculata, auriculis conspicue hamato-incurvatis, imbricatis, eroso-denticulatis; folia axillaria ramulorum basi integerrima; folia lateralia rhachidum secundariarum subhorizontalia, approximata, subfalcato-deltoidea, obtusiuscula vel acutiuscula, maxima $\pm$ 4 mm. longa, basi $\pm$ $1^1/_2$ mm. lata, semifacie superiore cellulis scleroticis anguste pellucido-marginata, basi rotundato-cuneata, vix denticulato-calcarata, semifacie inferiore basi truncato-cordata; lateralia ramulorum (pinnularum) subsimilia, contigua, minora, usque 3 mm. longa, magis falcata, basi superiore decurrenti-subplicata, basi inferiore truncata; folia intermedia erecta; intermedia rhachidum secundariarum subfalcato-lanceolata, usque 3 mm. longa, subacuta, utrinque anguste pellucido-marginata, basi interiore minute deflexo-calcarata, basi exteriore valde producta, auriculata, auricula conspicue hamato-incurvata; intermedia ramulorum minora, imbricata, subacuminata, basi interiore cuneata, basi exteriore rotundato-cordata. Spicae ad ramulos solitariae terminalesque, $\pm$ $1^1/_2$ mm. crassae; sporophylla triangulari-ovata, acuta, integerrima; macrosporae flavidae ad purpureo-brunneae, minute verruculosae; microsporae flavidae, copiose verruculosae, gibbis basalibus saepe paullo elongatis, curvatis vel flexuosis.

S. gracilis MOORE differs from this in having the axillary leaves of the branchlets 2-auriculate, commonly acutely hastate, and the lateral leaves (at least those of the secondary rhachises) distinctly calcarate-auriculate.

Ternate: Foramadiahi, on rocks in dark-shady ravine, alt. 500 m. (V. M. A. BEGUIN No. 1289, 9 January 1921).

Selaginella stipulata (BL.) SPRING, Mon. Lycop. II, 144; V. A. V. R., Mal. Fern All. 204.— *Lycopodium stipulatum* BL., Enum. Pl. Jav. II, 268.

Plants recently gathered near Buitenzorg (Java, Mt. Tjipoetih, along water-side in forest, alt. 600 m., R. C. BAKHUIZEN VAN DEN BRINK No. 5042, 24 September 1920) agree nearly exactly with specimens of this, occurring in the Buitenzorg Herbarium, determined by HIERONYMUS.— The stem is irregularly angular when dry, with the lower axillary leaves relatively large, 2 — 4-times as large as the lateral leaves; spikes 2 mm. diam; macrospores when young yellow-brown, at length brown, white-cretaceous, minutely verruculose or nearly smooth, with the projections roundish or slightly ruguliform; microspores pale-yellow or yellowish-white, densely clavate-tuberculate.

Selaginella heteromorpha V. A. V. R. in Bull. Btz. II, (1920) 183.

BÜNNEMEIJER's No. 8204 from Mt. Koerintji (Sumatra) differs in having the axillary leaves somewhat more elongated, varying from ovate to subobovate, broadest at or near the middle, the branched upper part of the shoots more copiously provided with accessory shoots in the axils of the pinnae and pinnulae, the leaves invariably entire, the lower sporophylla often sterile, reduced, those of the macro- and microsporangia nearly uniform.

Selaginella Usteri HIERON. in Leafl. Philipp. Bot. VI, 2055.

Var. **halmaheirae:** Caules breviores, usque + 75 cm. alti, parte ramosa deorsum copiose 3-pinnata, haud sub-4-pinnata, ramulis ultimis foliis lateralibus inclusis usque 5 mm. latis. Basi antica foliorum lateralium ramorum principalium conspicue revoluto-plicato-auriculata, ramulorum ultimorum leviter plicato-auriculata; basi foliorum intermediorum minus distincte rotundato-auriculata. Macrosporae . . . . ; microsporae cristis conspicue undulatis.

Perhaps a distinct species near *S. Usteri* HIERON. — Malay name: *Kèkètoe.*

Halmaheira: Galèla, road side, alt. 30 m. (V. M. A. BEGUIN No. 1788, 27 September 1921).

Selaginella muricata CES., Fel BECC. Polin., 9; V. A. V. R., Mal. Fern All. 218,

Var. **inermis** V.A.V.R., l.c.: A specimen from Ternate (Foramadiahi, in forest, alt. 550 m, V. M. A. BEGUIN No. 1183) is distinguished in having the shoots independent, erect, to 1 m. high, with the main stem pale-brown when dry, about 6—9 mm. thick, 5-stelical, hardly verruculose, rather smooth, opaque, with the leaves remote, erect, isomorphous, triangular,

bluntish, 2-auriculate-cordate at the base, the secondary rhachises 3-stelical, with the leaves subisomorphous, oblong, straight or subfalcate, bluntish, the base varying from rounded to narrowly incurvate-cordate; macrospores dark-brown, deciduously pruinose, copiously puncticulate-verruculose; microspores pale-yellowish, irregularly tuberculate-verruculose.

UEBER EINE WACHSART IM MILCHSAFT VON FICUS ALBA REINW.

von

A. J. ULTÉE.

Es ist eine bekannte Tatsache, dass der Michsaft von verschiedenen Ficusarten reich an Wachs ist, bisweilen dermassen, dass früher wohl von den Eingeborenen dieses Wachs zwecks Verwendung beim „Batikken" durch Eindampfen des Saftes gewonnen wurde.

U. a. muss das der Fall gewesen sein beim Wachse von *Ficus variegata* BL, *Ficus fulva* REINW. und *Ficus toxicaria* L. Indem aber jetzt allgemein Nebenproducte der Petroleumindustrie zu diesem Zwecke verwendet werden, hat dieses Wachs seine Bedeutung verloren.

In anderen Ficusarten kommt nur eine geringe Menge Wachs vor, z. B. im Milchsaft von *Ficus elastica* ROXB. [1]), in wieder anderen fehlt es vollständig, z. B. im Milchsaft von *Ficus Vogelii* MIQ. [2]).

Von keinem dieser Wachse ist die Zusammensetzung bekannt. Wohl haben Greshoff und Sack [3]) das Wachs von *Ficus variegata* (Cera Fici) untersucht und waren der Meinung, nachgewiesen zu haben, dass der wichtigste Bestandteil ein Ester von Ficocerylsäure und Ficocerylalkohol ist — beide nach G. und S. neue Verbindungen — aber vom Verfasser [4]) dieser Arbeit wurde festgestellt, dass diese Untersuchung den Tatsachen nicht entsprach und dass der s. g. Ficocerylalkohol mit β- Amyrin identisch ist. Eben so wenig ist die Ficocerylsäure eine neue Verbindung; unsere Untersuchung über diese Säure ist noch nicht abgeschlossen aber z. g. Z. hoffen wir den Beweis zu liefern, dass diese Säure ein Gemisch darstellt, das u. a. Palmitinsäure enthält.

Über das Wachs von *Ficus fulva* haben wir [5]) kürzlich eine Mitteilung publiziert. Wohl wurde die Stearinsäure in reinem Zustande isoliert, aber der Alkohol (Alkohole?) konnte wegen Materialmangels noch nicht studiert werden.

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[1]) Ultée, Chem. Weekbl. *9*. 773; (1912).
[2]) „ , Ber. Chem. Ges. *54*, 784; (1921).
[3]) Rec. Trav. Chim. Pays Bas. *20*, 65; (1901).
[4]) Pharm. Weekbl. *52*, 1097; (1915).
[5]) Dieses Bulletin. Vol. V, 105; (1922).

Wachse von anderen Ficusarten sind überhaupt noch nicht untersucht worden.

Es ist uns gelungen, in die Zusammensetzung des Wachses von *Ficus alba* REINW., Klarheit zu bringen deren, Milchsaft so reich an diesem Bestandteil ist, dass er gewiss in der "Batik"-Industrie Verwendung gefunden hätte, wenn der Baum nicht so selten wäre.

Am Ostabhang des Tengger-Gebirges (Ostjava) traf ich ein Exemplar einer Ficusart an, welche durch Dr. SMITH, Direktor am Herbarium des botanischen Gartens in Buitenzorg, als *Ficus alba* REINW. determiniert wurde.

Auf die übliche Weise wurde der Saft aus dem Stamm gewonnen und auf der Stelle mit Alkohol coaguliert, wodurch ich 20 g. des lufttrockenen Coagulums erhielt.

Der Feuchtigkeitsgehalt desselben betrug 1.1 %, der Aschengehalt 0.4 %.

Um das Wachs dar zu stellen, wurden 12 g. des Coagulums so oft mit der 50—fachen Menge Alkohol ausgekocht, bis nichts mehr in Lösung überging, was nach drei Extractionen gelang.

Nur ein geringer Rückstand blieb zurück, welcher u. a. Teilchen von Rinde und Schmutz enthielt, die beim Zapfen in den Saft geraten waren. Dieser Rückstand wurde mit Benzol ausgezogen um ev. vorhandenen Kautschuk in Lösung zu bringen. Durch Eindampfen dieser Benzollösung bis auf einige ccm. und Zufügen von Alkohol wurde ein geringer einigermassen kautschukähnlicher Niederschlag erhalten. Der Gehalt dieses Milchsaftes an Kautschuk (falls überhaupt vorhanden) ist also sehr gering; weniger als 1/4 % des Coagulums.

Demgegenüber ist die Menge Wachs sehr gross; aus den beiden ersten alkoholischen Auszügen erhielt ich resp. 4.9 und 3.5 g. mit den Schmelzpunkten 56—58° und 57—59°, indem sich durch Eindampfen der sämtlichen Mutterlaugen noch 1.8 g, S=53—60°, ausschied, im Ganzen also 10.2 g. Die festen Bestandteile des Michsafts von *Ficus alba* setzen sich also in der Hauptsache aus Wachs zusammen.

Dieses Wachs wurde auf die bei *Ficus fulva* beschriebene Weise behandelt, wodurch eine Fettsäure und ein hochmolekularer Alkohol, im Verhältnis 1 : ± 1.5, erhalten wurde.

Es stellte sich heraus, dass die Säure ebenso wie bei *Ficus fulva* Stearinsäure war. Sie wurde leicht in glänzenden Blättchen, S = 69°, erhalten. Bei Mischung mit reiner Stearinsäure wurde keine Schmelzpunkt- Erniedrigung konstatiert, 0.3757 g. verbrauchten zur Neutralisation (Phenolphthaleïn) 10.1 ccm. 0.1300 n. NaOH, entsprechend einem Mol. Gew. 286, übereinstimmend mit dem der Stearinsäure, derer M. G. 284 ist.

Der Alkohol gab die Phytosterin- Reaktionen von Salkowski und Liebermann, war aber nicht identisch mit dem Sterin von *Ficus fulva*, die botanisch in naher Beziehung zu *Ficus alba* steht, da beide der Sektion *Eusyce* angehören.

Es stellte sich heraus, dass der Alkohol ein Gemisch von Sterinen war, das durch Umkristallisation nicht getrennt werden konnte. Dies gelang aber wohl mittels der Acetate, die durch Kochen der Alkohole mit einer gleichen Menge Natriumacetat (wasserfrei) und der zehnfachen Menge Essigsäureanhydrid bereitet wurden. Durch fractionierte Kristallisation aus Alkohol wurde ziemlich leicht die schwerstlösliche Verbindung mit einem konstanten Schmelzpunkte von 235° erhalten, weniger leicht ein zweites Acetat, das bei 213° schmolz. Diese Schmelzpunkte sind identisch mit denen von β-Amyrinacetat und Lupeolacetat. Dass tatsächlich diese Verbindungen vorlagen, ging aus Mischproben mit reinem β- Amyrinacetat und Lupeolacetat hervor, wobei keine Schmelzpunkt-Erniedrigung festgestellt wurde.

Weiter wurde jedes der Acetate verseift und so Alkohole erhalten, die bei 195° und 211° schmolzen, welche Schmelzpunkte mit denen von β-Amyrin und Lupeol übereinstimmen und keine Abänderung zeigten, als resp. mit reinem β- Amyrin und Lupeol gemischt wurde.

Zum Schluss wurde aus den Mutterlaugen der Acetate nach Verseifung und Benzoylierung mit Benzoylchlorid und Pyridin das schwer lösliche Benzoat, S = 265°, erzielt, das sich mit Lupeolbenzoat identisch zeigte.

Das Wachs von *Ficus alba* setzt sich also hauptsächlich aus einem Gemisch von β- Amyrinstearinat und Lupeolstearinat zusammen.

Es ist nicht ausgeschlossen, dass noch Stearinate von anderen Sterinen anwesend sind, wenn auch die Möglichkeit, dass sie in einigermassen reichlicher Menge vorkommen, gering ist. Ein Drittel der Sterine wurde ja als reiner β- Amyrinacetat erhalten, ungefähr eben soviel als Lupeolacetat. Falls ein drittes Sterin, z. B. α- Amyrin in bedeutender Menge anwesend wäre, so müsste die Trennung von β- Amyrinacetat und Lupeolacetat viel schwerer zu erzielen sein.

Verbindungen von höheren Fettsäuren und Sterinen waren bis jetzt noch nicht aus Milchsäften isoliert worden. Da aber in Milchsäften, nicht allein von *Ficus abla*, öfters Wachs nachgewiesen wurde, ist die Wahrscheinlichkeit gross, dass sie häufig vorkommen.

Eine Verbindung von β- Amyrin und Palmitinsäure wurde von Hesse [1]) aus dem Wachs der Coca-Blätter abgesondert.

[1]) Lieb. Ann. *271*, 184; (1892).

TAFELN JAVANISCHER ORCHIDEEN

von

J. J. SMITH.

Unter obigem Titel beabsichtige ich die Figuren der in den Nachträgen zu „die Orchideen von Java" behandelten Arten zu veröffentlichen.

Tab. 18.

Neuwiedia veratrifolia Bl. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 1.

a. Unpaares Sepalum $^{2}/_{1}$.
b. Paariges Sepalum $^{2}/_{1}$.
c. Petalum $^{2}/_{1}$.
d. Labellum $^{2}/_{1}$.
e. Säule von oben $^{3}/_{1}$.
f. Griffel von unten $^{4}/_{1}$.

II. **Neuwiedia Zollingeri** Rchb. f. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 3.

a. Blüte von der Seite $^{2}/_{1}$.
b. Blüte von unten $^{2}/_{1}$.
c. Unpaares Sepalum $^{7}/_{5}$.
d. Paariges Sepalum $^{3}/_{2}$.
e. Petalum $^{8}/_{5}$.
f. Labellum $^{3}/_{2}$.
g. Fruchtknoten mit Säule $^{8}/_{5}$.
h. Frucht $^{4}/_{3}$.
i. Querschnitt der Frucht $^{4}/_{3}$.

III. **Apostasia Wallichii** R. Br. J. J. S. in Bull. Dép. Agr. Ind. néerl. XIII (1907), 1.
(Nach einem sumatranischen Exemplar).

a. Blüte $^{13}/_{2}$.
b. Unpaares Sepalum $^{5}/_{1}$.
c. Paariges Sepalum $^{5}/_{1}$.
d. Petalum $^{4}/_{1}$.
e. Säule von oben $^{11}/_{2}$.
f. Säule von der Seite $^{11}/_{2}$.

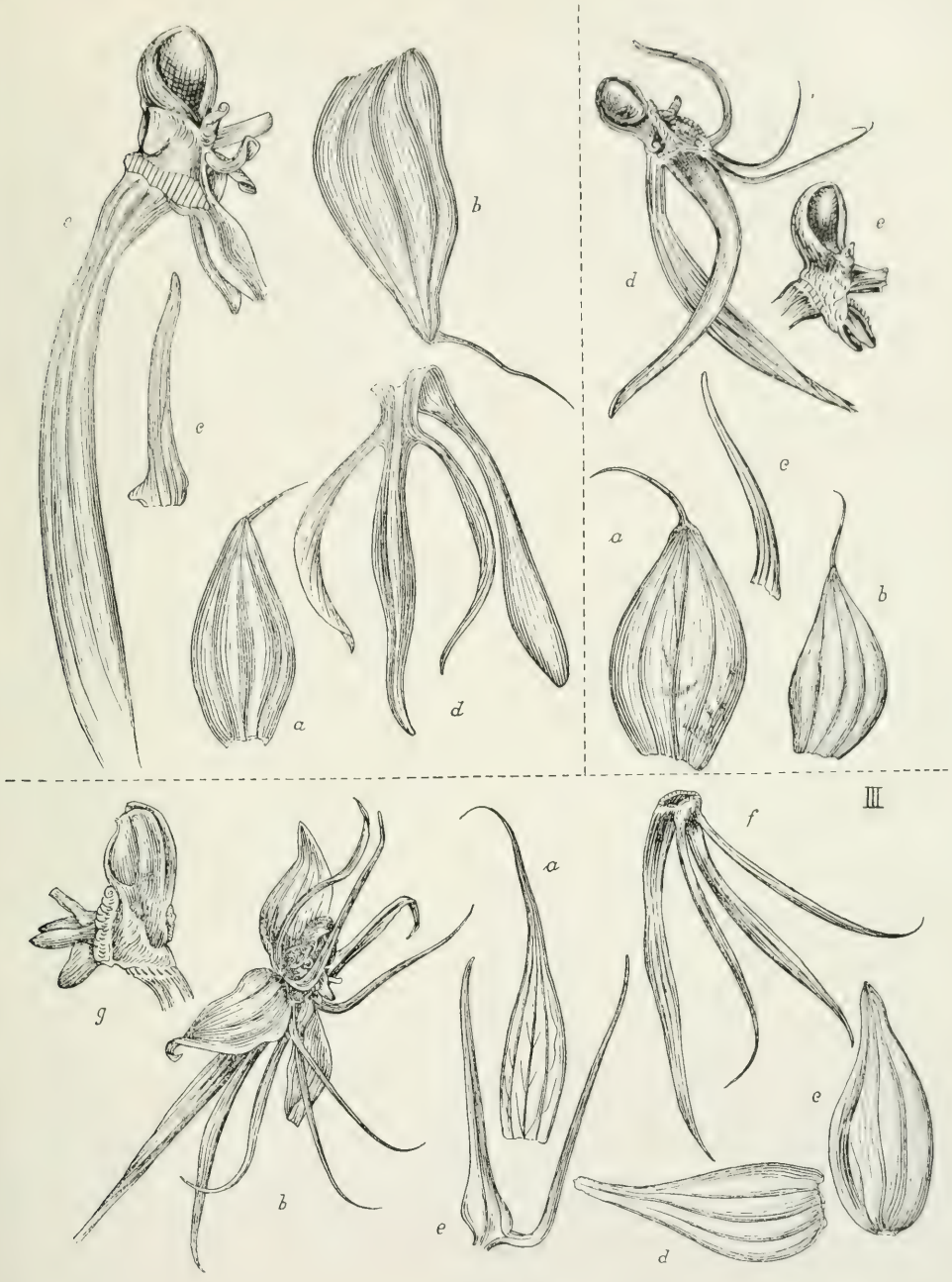
J. J. SMITH, del.

Tab. 19.

I. **Habenaria Backeri** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 13.
   a. Unpaares Sepalum $^{2}/_{1}$.
   b. Paariges Sepalum $^{13}/_{5}$.
   c. Petalum $^{11}/_{5}$.
   d. Lippe $^{3}/_{1}$.
   e. Säule $^{4}/_{1}$.

II. **Habenaria Koordersii** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 2.
   a. Unpaares Sepalum $^{7}/_{2}$.
   b. Paariges Sepalum $^{2}/_{1}$.
   c. Petalum $^{7}/_{3}$.
   d. Lippe und Säule $^{5}/_{2}$.
   e. Säule $^{3}/_{1}$.

III. **Habenaria bantamensis** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 5.
   a. Braktee $^{11}/_{5}$.
   b. Blüte $^{2}/_{1}$.
   c. Unpaares Sepalum $^{16}/_{5}$.
   d. Paariges Sepalum $^{16}/_{5}$.
   e. Petalum $^{3}/_{1}$.
   f. Lippe $^{5}/_{2}$.
   g. Säule $^{5}/_{1}$.



J. J. SMITH, del.

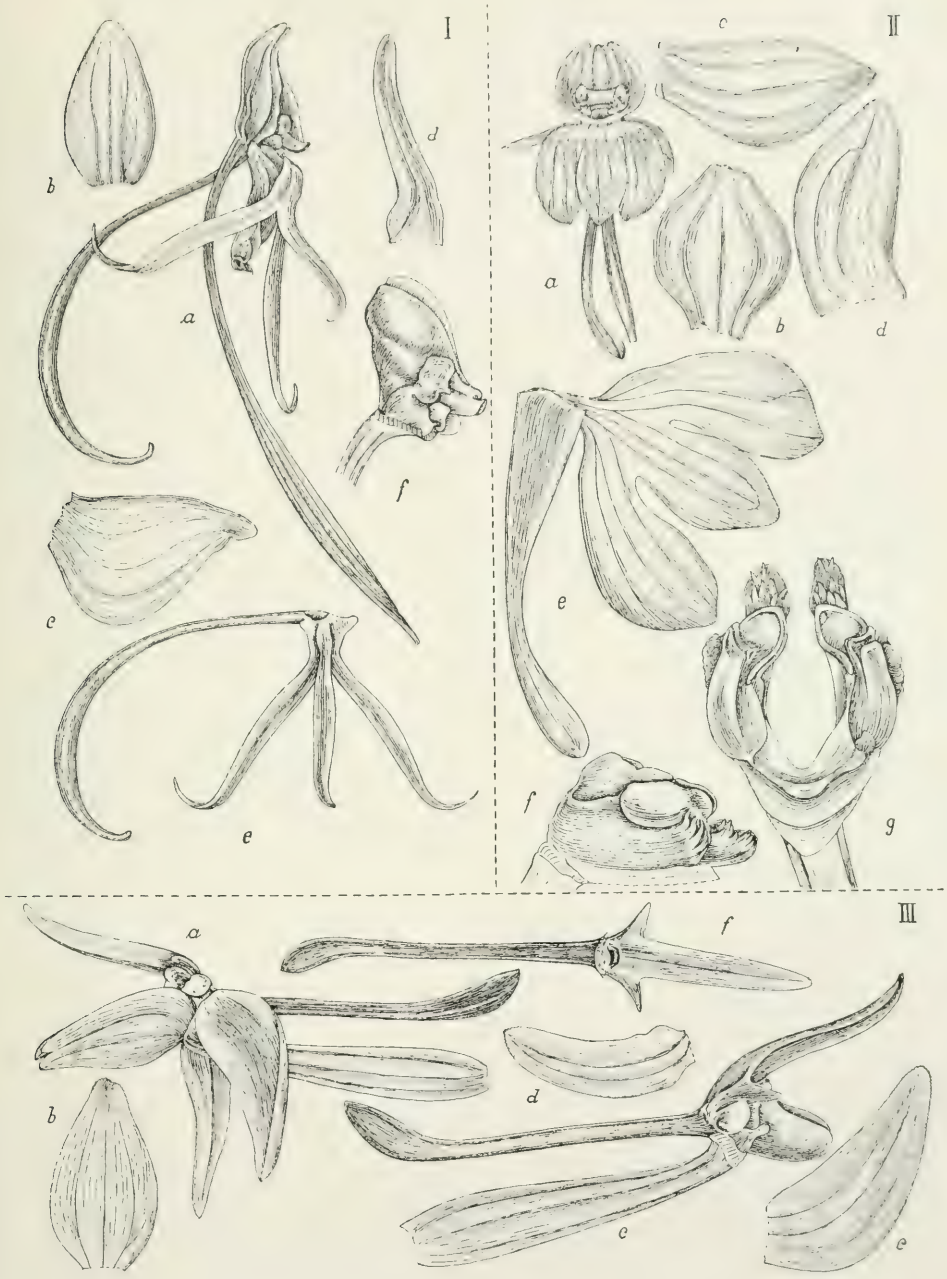
Tab. 20.

I. **Habenaria curvicalcar** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 8.
   a. Blüte $^{10}/_{3}$.
   b. Unpaares Sepalum $^{16}/_{3}$.
   c. Paariges Sepalum $^{5}/_{1}$.
   d. Petalum $^{6}/_{1}$.
   e. Lippe $^{3}/_{1}$.
   f. Säule $^{15}/_{2}$.

II. **Habenaria Loerzingii** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 16.
   a. Blüte $^{2}/_{1}$.
   b. Unpaares Sepalum $^{5}/_{1}$.
   c. Paariges Sepalum $^{5}/_{1}$.
   d. Petalum $^{5}/_{1}$.
   e. Lippe $^{11}/_{2}$.
   f. Säule von der Seite $^{5}/_{1}$.
   g. Säule von oben $^{15}/_{2}$.

III. **Habenaria Rumphii** Lndl. var. **javanica** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 12.
   a. Blüte $^{9}/_{2}$.
   b. Unpaares Sepalum $^{6}/_{1}$.
   c. Paariges Sepalum $^{17}/_{3}$.
   d. Petalum $^{17}/_{3}$.
   e. Lippe und Säule $^{5}/_{1}$.
   f. Lippe $^{14}/_{3}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



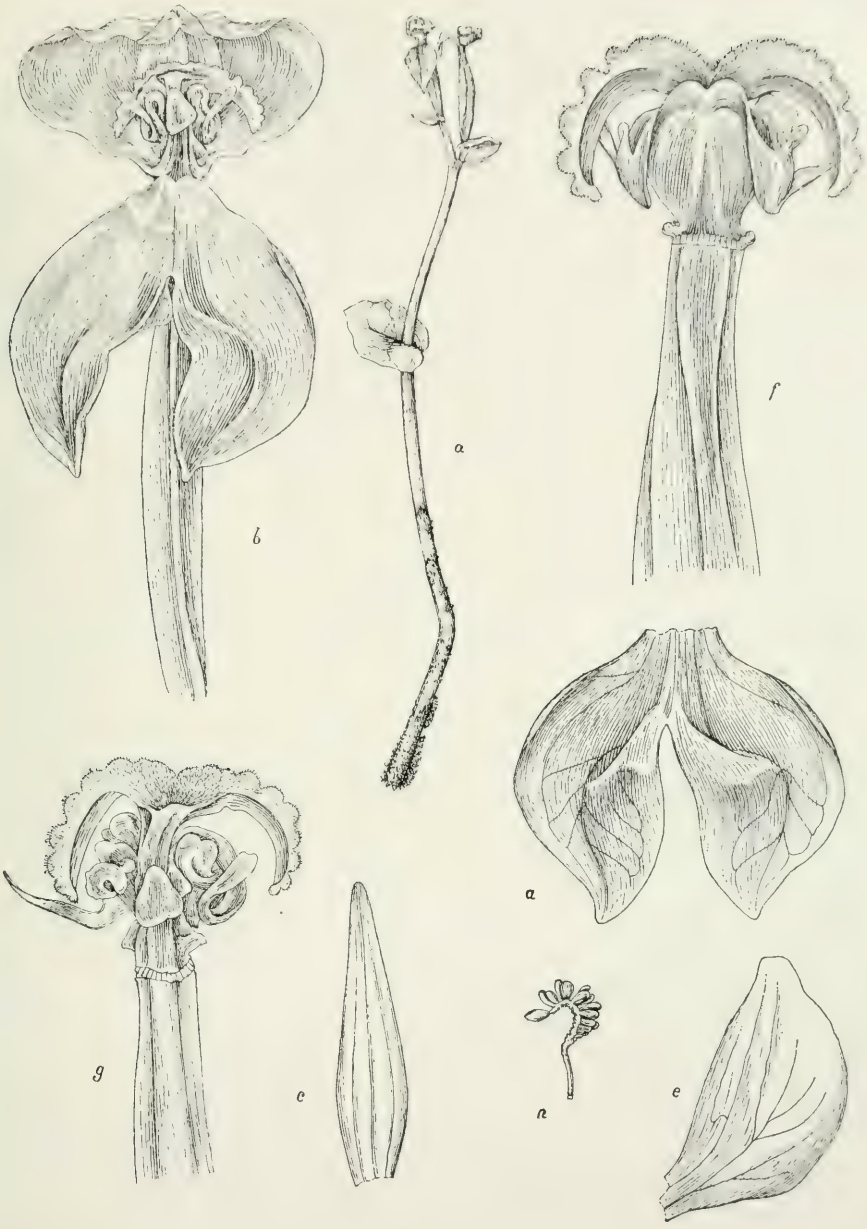
J. J. SMITH, del.

Tab. 21.

Disperis javanica J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 19.

a. Pflanze $^{1}/_{1}$.
b. Blüte $^{6}/_{1}$.
c. Unpaares Sepalum $^{6}/_{1}$.
d. Paariges Sepalum $^{5}/_{1}$.
e. Petalum $^{4}/_{1}$.
f. Lippe und Säule von oben $^{10}/_{1}$.
g. Dieselben von unten $^{8}/_{1}$.
h. Pollinium $^{15}/_{1}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



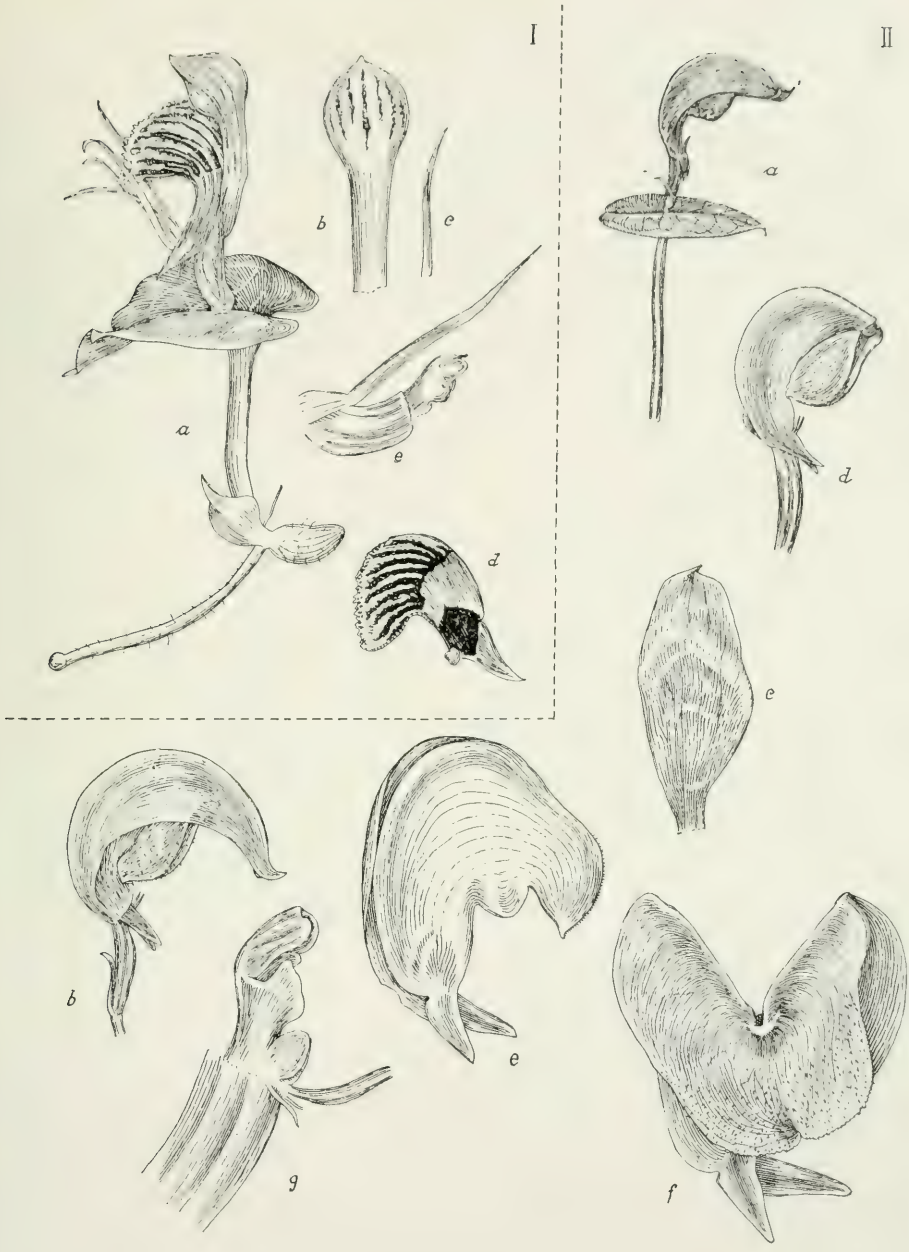
J. J. SMITH, del.

Tab. 22.

I. **Corysanthes carinata** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XIII (1907), 8.
   a. Pflanze $^{4}/_{3}$.
   b. Unpaares Sepalum $^{3}/_{2}$.
   c. Paariges Sepalum $^{5}/_{3}$.
   d. Längsschnitt der Lippe $^{7}/_{4}$.
   e. Säule $^{4}/_{1}$.

II. **Corysanthes imperatoria** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 22.
   a. Pflanze $^{3}/_{2}$.
   b. Blüte $^{2}/_{1}$.
   c. Unpaares Sepalum $^{2}/_{1}$.
   d. Lippe von der Seite $^{11}/_{2}$.
   e. Lippe der Länge nach zusammengelegt $^{4}/_{1}$.
   f. Lippe der Breite nach zusammengelegt $^{9}/_{2}$.
   g. Säule $^{9}/_{1}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



J. J. SMITH, del.

TAB. 23.

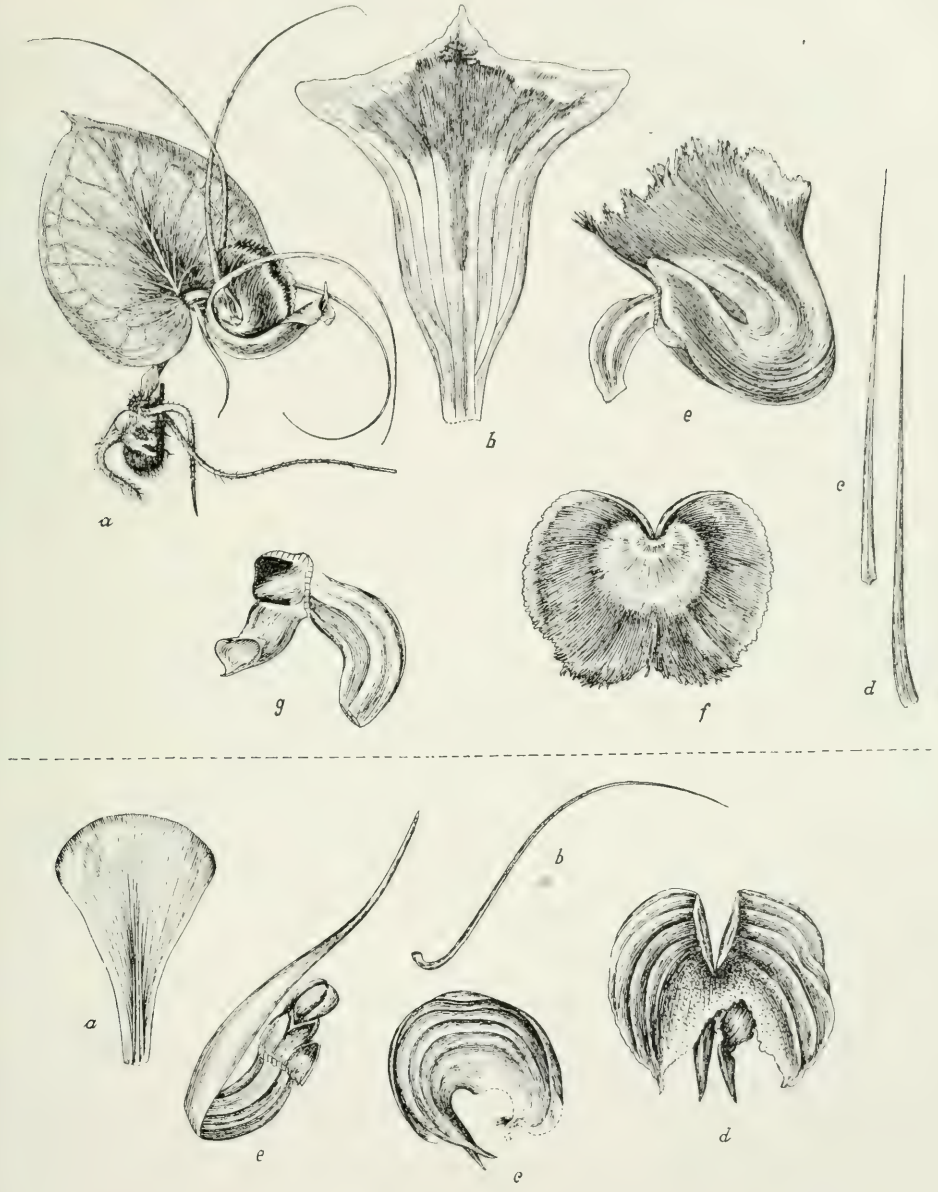
I. **Corysanthes picta** LNDL. var. **karangensis** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 230.

a. Pflanze $^{6}/_{5}$.
b. Unpaares Sepalum $^{14}/_{5}$.
c. Paariges Sepalum $^{1}/_{1}$.
d. Petalum $^{1}/_{1}$.
e. Lippe von der Seite $^{5}/_{2}$.
f. Lippe der Breite nach zusammengelegt $^{4}/_{3}$.
g .Säule $^{9}/_{2}$.

II. **Corysanthes vinosa** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 233.

a. Unpaares Sepalum $^{4}/_{3}$.
b. Petalum $^{7}/_{5}$.
c. Lippe von der Seite (beschädigt) $^{2}/_{1}$.
d. Lippe der Breite nach zusammengelegt $^{9}/_{4}$.
e. Säule $^{19}/_{4}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



J. J. SMITH, del.

Tab. 24.

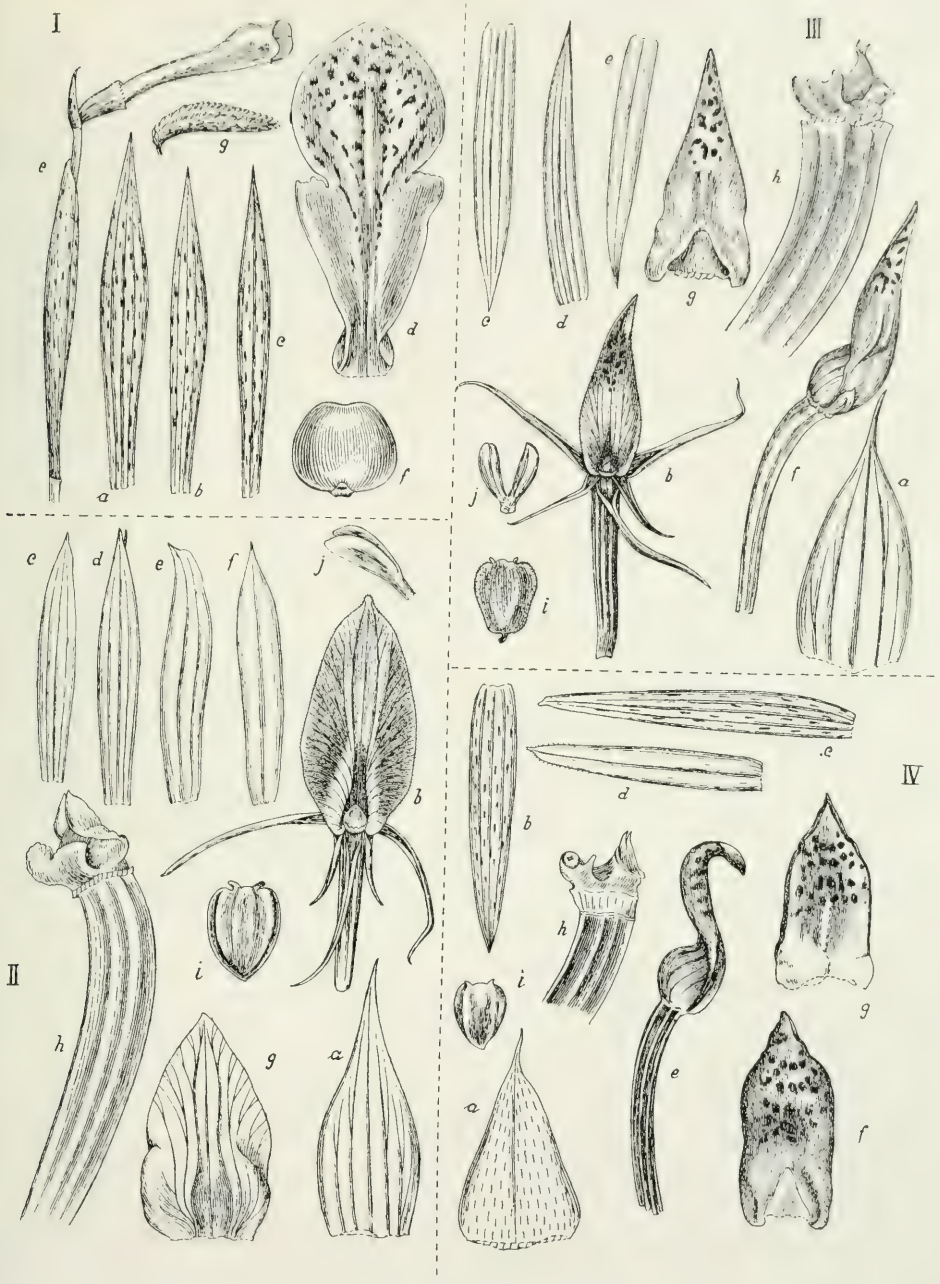
I. **Nervilia Winckelii** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 1.
- a. Unpaares Sepalum $^{3}/_{2}$.
- b. Paariges Sepalum $^{3}/_{2}$.
- c. Petalum $^{3}/_{2}$..
- d. Lippe $^{7}/_{5}$.
- e. Säule $^{3}/_{2}$.
- f. Anthere $^{7}/_{2}$.

II. **Cryptostylis conspicua** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 247.
- a. Braktee $^{5}/_{3}$.
- b. Blüte $^{5}/_{4}$.
- c. Unpaares Sepalum $^{5}/_{3}$.
- d. Paariges Sepalum $^{5}/_{3}$.
- e, f. Petalen $^{7}/_{2}$.
- g. Lippe ausgebreitet $^{5}/_{3}$.
- h. Säule $^{3}/_{1}$.
- i. Anthere $^{7}/_{4}$.
- j. Pollinium $^{6}/_{1}$.

III. **Cryptostylis acutata** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 243.
- a. Braktee $^{2}/_{1}$.
- b. Blüte $^{6}/_{5}$.
- c. Unpaares Sepalum $^{11}/_{5}$.
- d. Paariges Sepalum $^{2}/_{1}$.
- e. Petalum $^{3}/_{1}$.
- f. Lippe und Säule $^{8}/_{5}$.
- g. Lippe ausgebreitet $^{5}/_{3}$.
- h. Säule $^{5}/_{1}$.
- i. Anthere $^{13}/_{2}$.
- j. Pollinarium $^{6}/_{1}$.

IV. **Cryptostylis arachnites** Hassk. J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 240.
- a. Braktee $^{3}/_{1}$.
- b. Unpaares Sepalum $^{2}/_{1}$.
- c. Paariges Sepalum $^{3}/_{1}$.
- d. Petalum $^{7}/_{2}$.
- e. Lippe von der Seite $^{3}/_{2}$.
- f, g. Lippe ausgebreitet $^{5}/_{3}$.
- h. Säule $^{7}/_{2}$.
- i. Anthere $^{11}/_{2}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



J. J. SMITH, del.

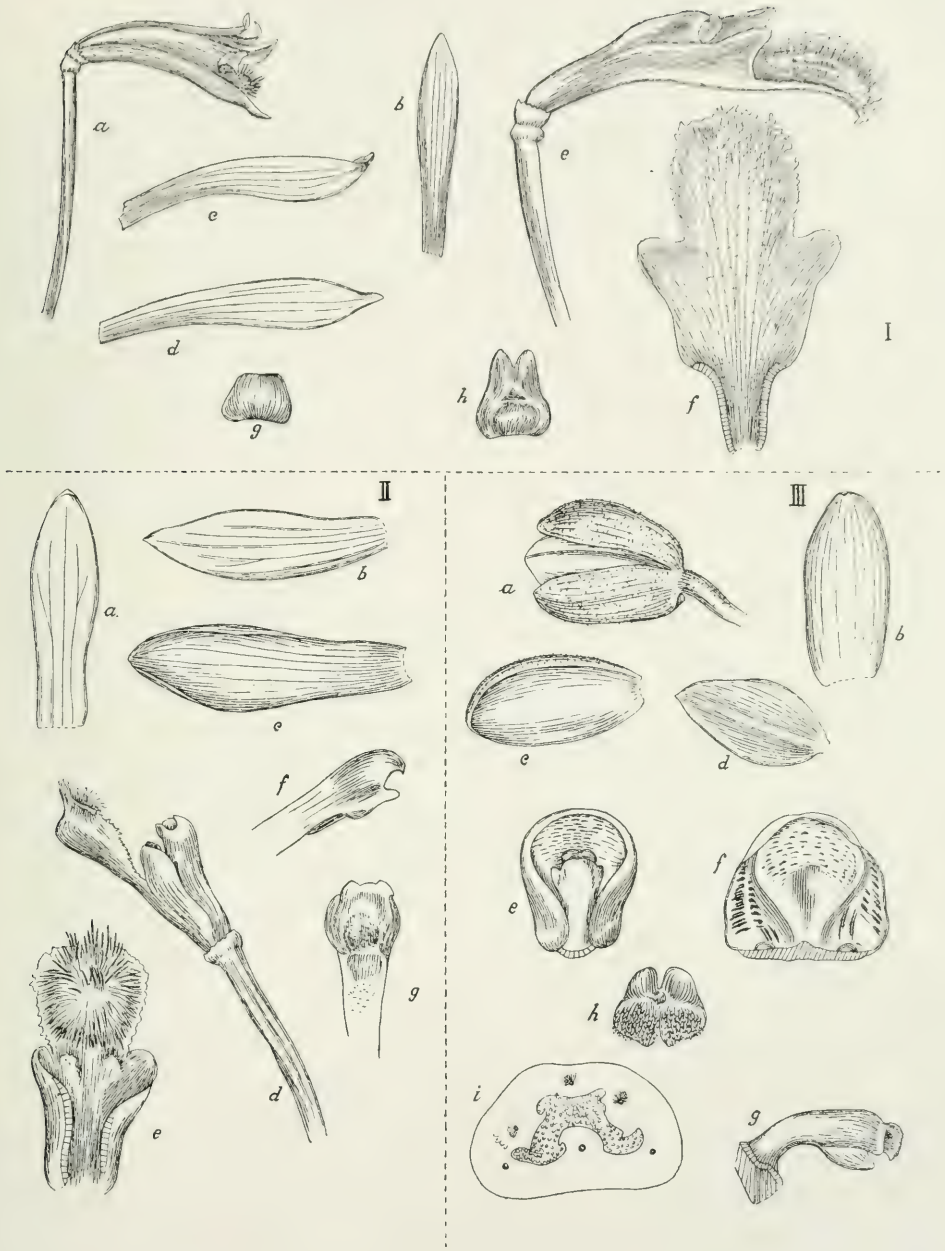
Tab. 25.

I. **Lecanorchis pauciflora** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 6.
- a. Blüte $^{5}/_{3}$.
- b. Unpaares Sepalum $^{7}/_{4}$.
- c. Paariges Sepalum $^{2}/_{1}$.
- d. Petalum $^{9}/_{4}$.
- e. Lippe und Säule $^{3}/_{1}$.
- f. Lippe ausgebreitet $^{13}/_{4}$.
- g. Anthere von vorne $^{19}/_{3}$.
- h. Anthere von oben $^{13}/_{2}$.

II. **Lecanorchis multiflora** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 8.
- a. Unpaares Sepalum $^{11}/_{3}$.
- b. Paariges Sepalum $^{15}/_{4}$.
- c. Petalum $^{13}/_{3}$.
- d. Lippe und Säule $^{7}/_{2}$.
- e. Lippe ausgebreitet $^{4}/_{1}$.
- f. Säule von der Seite $^{6}/_{1}$.
- g. Säule von unten $^{6}/_{1}$.

III. **Galeola javanica** Bth. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 12.
- a. Blüte $^{3}/_{2}$.
- b. Unpaares Sepalum $^{8}/_{5}$.
- c. Paariges Sepalum $^{3}/_{2}$.
- d. Petalum $^{4}/_{3}$.
- e. Lippe und Säule von oben $^{7}/_{4}$.
- f. Lippe ausgebreitet $^{2}/_{1}$.
- g. Säule $^{5}/_{2}$.
- h. Anthere $^{11}/_{2}$.
- i. Frucht im Querschnitt $^{5}/_{4}$.

J. J. SMITH: *Tafeln javanische Orchideen.*



J. J. SMITH, del.

Tab. 26.

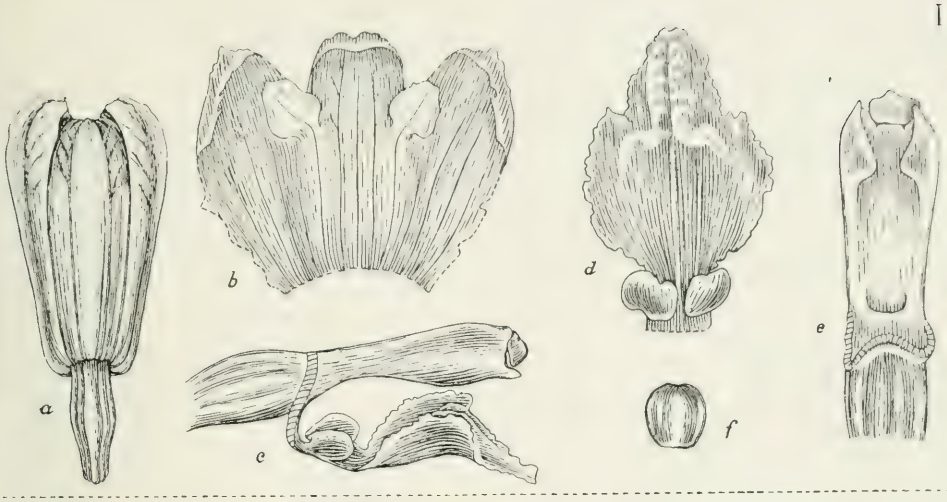
I. **Gastrodia crispa** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 248.

a. Blüte von oben $^{2}/_{1}$.
b. Sepalen und Petalen ausgebreitet $^{9}/_{5}$.
c. Lippe und Säule $^{4}/_{1}$.
d. Lippe ausgebreitet $^{5}/_{1}$.
e. Säule von unten $^{5}/_{1}$.
f. Anthere $^{16}/_{3}$.

II. **Didymoplexis obreniformis** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XIV (1914), 26.

a. Blüte von unten $^{7}/_{2}$.
b. Blüte von der Seite $^{4}/_{1}$.
c. Unpaares Sepalum und Petalen $^{4}/_{1}$.
d. Paarige Sepalen $^{3}/_{1}$.
e. Lippe von der Seite $^{5}/_{1}$.
f. Lippe ausgebreitet $^{6}/_{1}$.
g. Säule von der Seite $^{15}/_{2}$.
h. Säule von unten $^{8}/_{7}$.
i. Anthere $^{7}/_{1}$.

I



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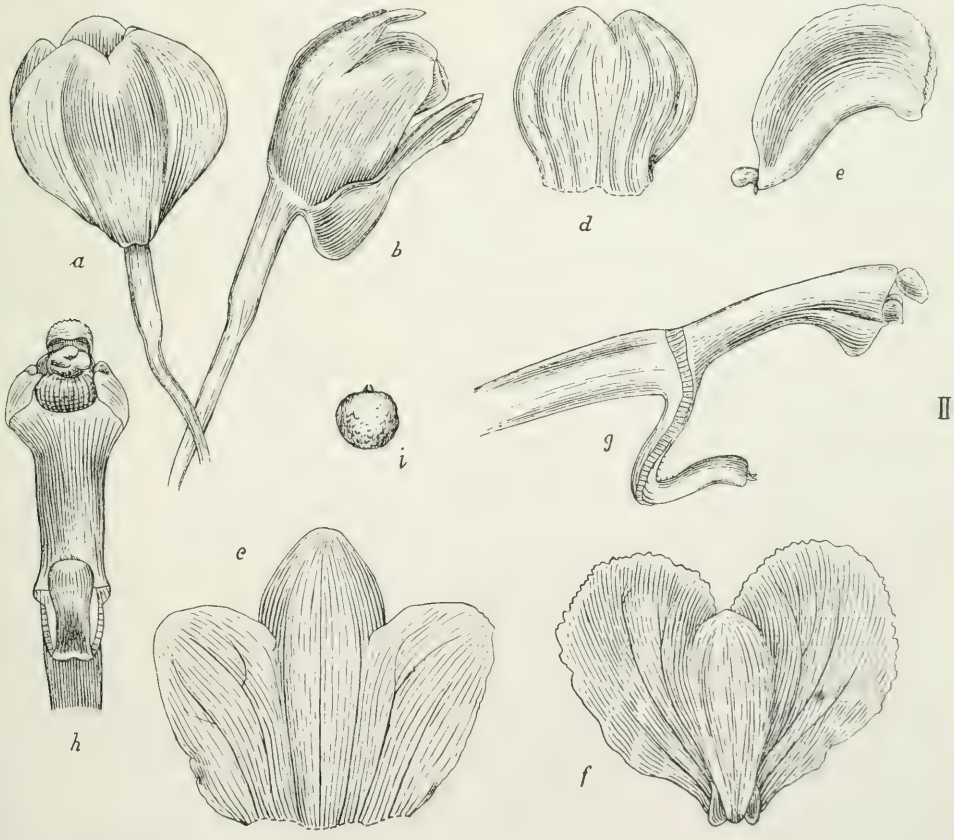


J. J. SMITH, del.

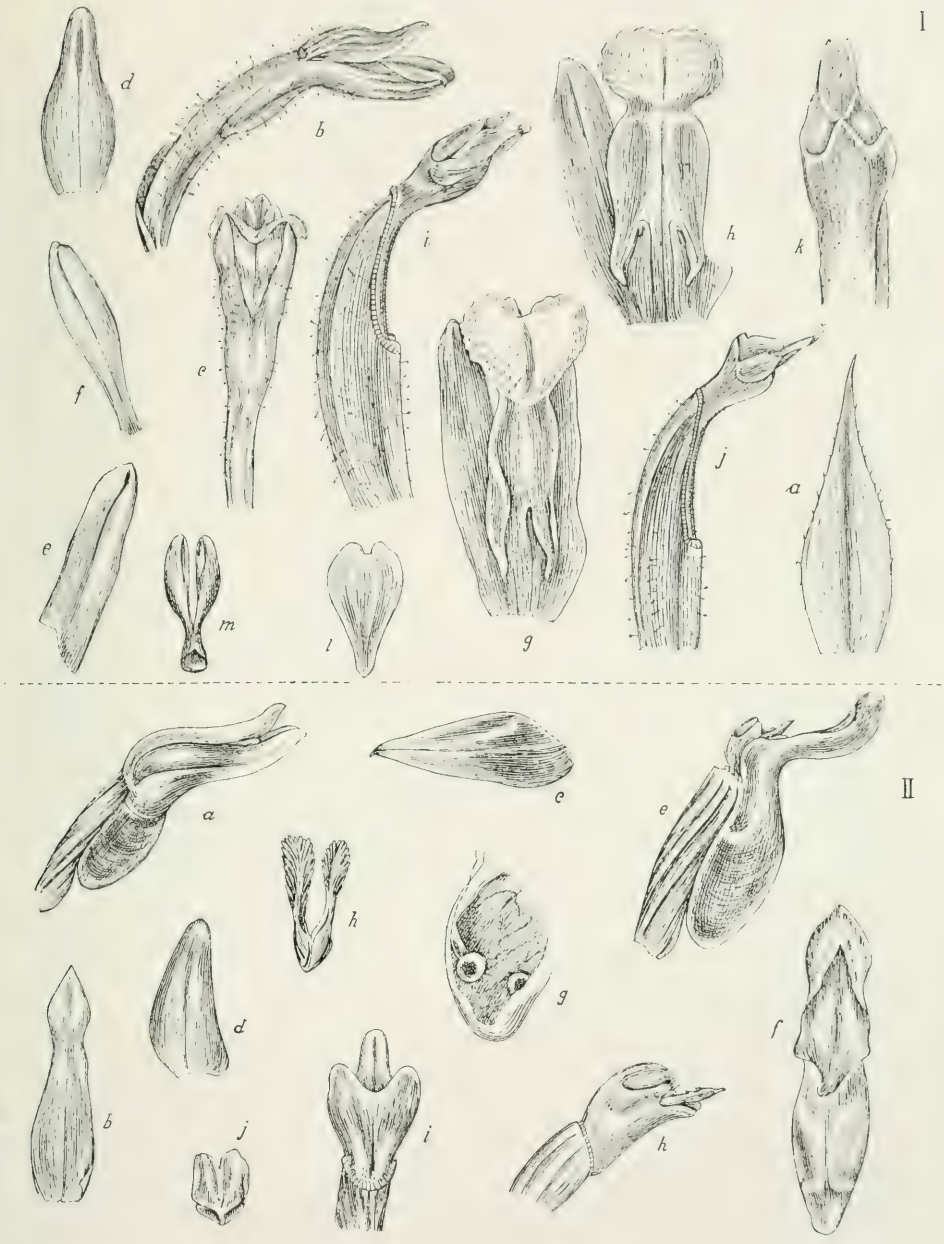
Tab. 27.

I. **Spiranthes obliqua** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 74.

a. Braktee $^{5}/_{1}$.
b. Blüte von der Seite $^{5}/_{1}$.
c. Blüte von unten $^{5}/_{1}$.
d. Unpaares Sepalum $^{27}/_{4}$.
e. Paariges Sepalum $^{11}/_{2}$.
f. Petalum $^{9}/_{1}$.
g. Paarige Sepalen und Lippe $^{7}/_{1}$.
h. Dieselben ausgebreitet $^{6}/_{1}$.
i. Säule von der Seite $^{20}/_{3}$.
j. Dieselbe ohne Anthere $^{20}/_{3}$.
k. Dieselbe von oben $^{15}/_{1}$.
l. Anthere $^{13}/_{1}$.
m. Pollinarium $^{12}/_{1}$.

II. **Vrydagzynea purpurea** Bl.: J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 252.

a. Blüte $^{4}/_{1}$.
b. Unpaares Sepalum $^{11}/_{2}$.
c. Paariges Sepalum $^{4}/_{1}$.
d. Petalum $^{5}/_{1}$.
e. Lippe und Säule $^{17}/_{3}$.
f. Lippe ausgelegt $^{6}/_{1}$.
g. Sporn von innen $^{13}/_{2}$.
h. Säule von der Seite $^{9}/_{1}$.
i. Säule von unten $^{9}/_{1}$.
j. Anthere $^{28}/_{3}$.
k. Pollinarium $^{9}/_{1}$.



J. J. SMITH, del.

Tab. 28.

I. **Cheirostylis javanica** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 14.

a. Braktee $^{4}/_{1}$.
b. Blüte $^{18}/_{5}$.
c. Sepalen $^{5}/_{1}$.
d. Petalum $^{13}/_{2}$.
e. Lippe und Saüle $^{4}/_{1}$.
f, g. Lippen $^{19}/_{4}$.
h. Säule von oben $^{17}/_{3}$.
i. Säule von unten $^{17}/_{3}$.
j. Anthere $^{6}/_{1}$.
k. Pollinarium $^{10}/_{1}$.

II. **Macodes robusta** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 254.

a. Blüte $^{2}/_{1}$.
b. Unpaares Sepalum $^{17}/_{4}$.
c. Paariges Sepalum $^{3}/_{1}$.
d, e. Petalen $^{14}/_{3}$.
f. Lippe und Säule $^{17}/_{4}$.
g. Lippe $^{5}/_{1}$.
h. Schwiele im Sporn $^{11}/_{1}$.
i. Säule $^{7}/_{2}$.
j. Anthere $^{4}/_{1}$.
k. Pollinarium $^{6}/_{1}$.

III. **Goodyera sphingoides** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 18.

a. Braktee $^{4}/_{1}$.
b. Blüte $^{11}/_{3}$.
c. Unpaares Sepalum $^{5}/_{1}$.
d. Paariges Sepalum $^{5}/_{1}$.
e. Petalum $^{6}/_{1}$.
f. Lippe ausgebreitet $^{6}/_{1}$.
g. Säule $^{5}/_{1}$.
h. Anthere $^{10}/_{1}$.

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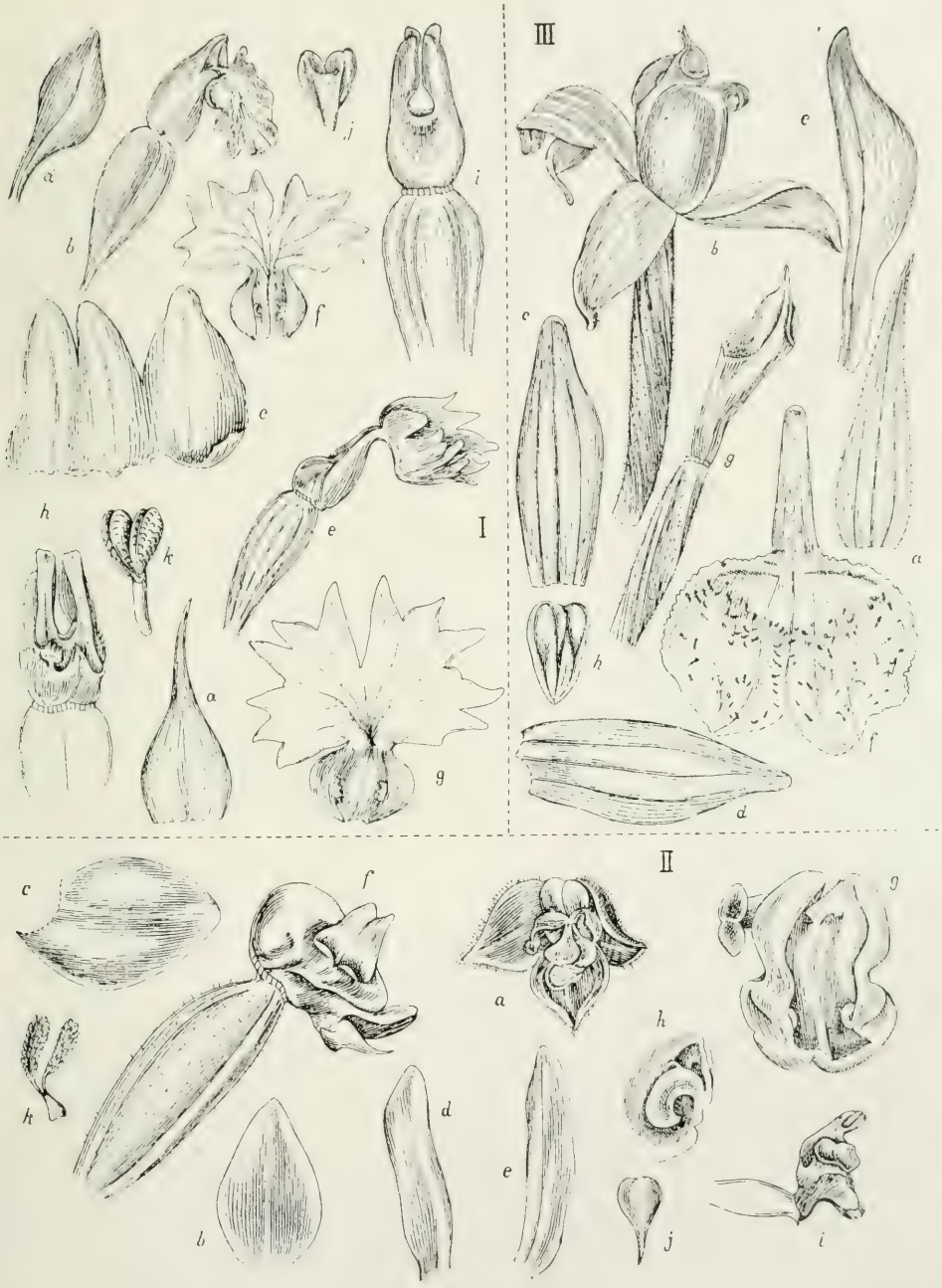

J. J. SMITH, del.

TAB. 29.

I. **Goodyera glauca** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XIII (1907), 17.

a. Blüte $^{7}/_{3}$.
b. Unpaares Sepalum $^{2}/_{1}$.
c. Paariges Sepalum $^{2}/_{1}$.
d. Petalum $^{3}/_{1}$.
e. Lippe und Säule $^{10}/_{3}$.
f. Lippe ausgebreitet $^{13}/_{5}$.
g. Säule $^{13}/_{5}$.
h. Anthere $^{8}/_{3}$.

II. **Tropidia angulosa** BL. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 21.

a. Blüte $^{4}/_{1}$.
b. Unpaares Sepalum $^{11}/_{3}$.
c. Paariges Sepalen $^{3}/_{1}$.
d. Petalum $^{7}/_{2}$.
e. Lippe und Säule $^{5}/_{2}$.
f. Lippe ausgebreitet $^{4}/_{1}$.
g. Säule $^{13}/_{4}$.
h. Anthere $^{17}/_{3}$.

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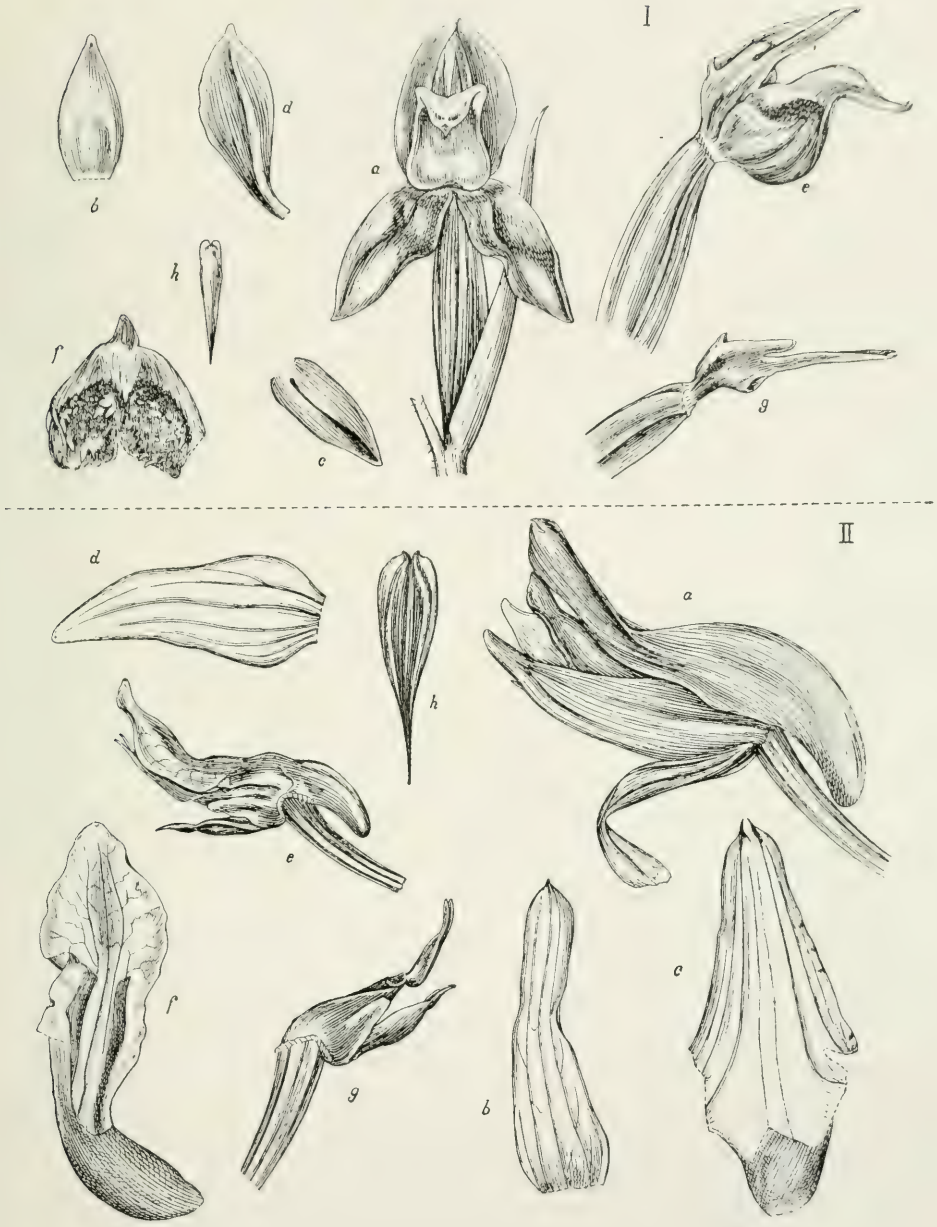

J. J. SMITH, del.

Tab. 30.

I. **Pholidota camelostalix** Rchb. F. J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 258.
- a. Blüte $^{13}/_{4}$.
- b. Paariges Sepalum $^{4}/_{1}$.
- c, d. Petalen $^{11}/_{3}$.
- e. Lippe und Säule $^{4}/_{1}$.
- f. Lippe $^{5}/_{1}$.
- g. Lippe ausgebreitet $^{9}/_{2}$.
- h. Säule $^{5}/_{1}$.

II. **Pholidota Convallariae** Hook. F. J. J. S. in Bull. Jard. Bot. Buit. 2 sér. IX (1913), 23.
- a. Blüte $^{3}/_{1}$.
- b. Unpaares Sepalum $^{4}/_{1}$.
- c. Paariges Sepalum $^{17}/_{4}$.
- d. Petalum $^{24}/_{5}$.
- e. Lippe und Säule $^{4}/_{1}$.
- f. Lippe ausgebreitet $^{5}/_{1}$.
- g. Säule $^{5}/_{1}$.
- h. Anthere $^{7}/_{1}$.

III. **Dendrochilum? Zollingeri** Miq. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 13.
- a. Braktee $^{17}/_{3}$.
- b. Unpaares Sepalum $^{4}/_{7}$.
- c. Paariges Sepalum $^{13}/_{3}$.
- d. Petalum $^{13}/_{3}$.
- e. Lippe und Säule $^{13}/_{2}$.
- f. Lippe ausgelegt $^{19}/_{3}$.
- g. Anthere $^{9}/_{1}$.

IV. **Dendrochilum brachyotum** Rchb. F. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 24.
- a. Braktee $^{5}/_{1}$.
- b. Unpaares Sepalum $^{5}/_{1}$.
- c. Paariges Sepalum $^{5}/_{1}$.
- d. Petalum $^{6}/_{1}$.
- e. Lippe und Säule $^{19}/_{3}$.
- f. Lippe ausgebreitet $^{8}/_{1}$.
- g. Säule von der Seite $^{14}/_{1}$.
- h. Säule von unten $^{16}/_{1}$.
- i. Anthere $^{14}/_{1}$.

V. **Dendrochilum exalatum** J. J. S. in Bull, Jard. Bot. Buit. 2e sér. XIV (1914), 29.
- a. Unpaares Sepalum $^{6}/_{1}$.
- b. Paariges Sepalum $^{6}/_{1}$.
- c. Petalum $^{11}/_{2}$.
- d. Lippe ausgebreitet $^{15}/_{2}$.
- e. Säule von der Seite $^{8}/_{1}$.
- f. Säule von unten $^{19}/_{2}$.
- g. Anthere $^{20}/_{1}$.

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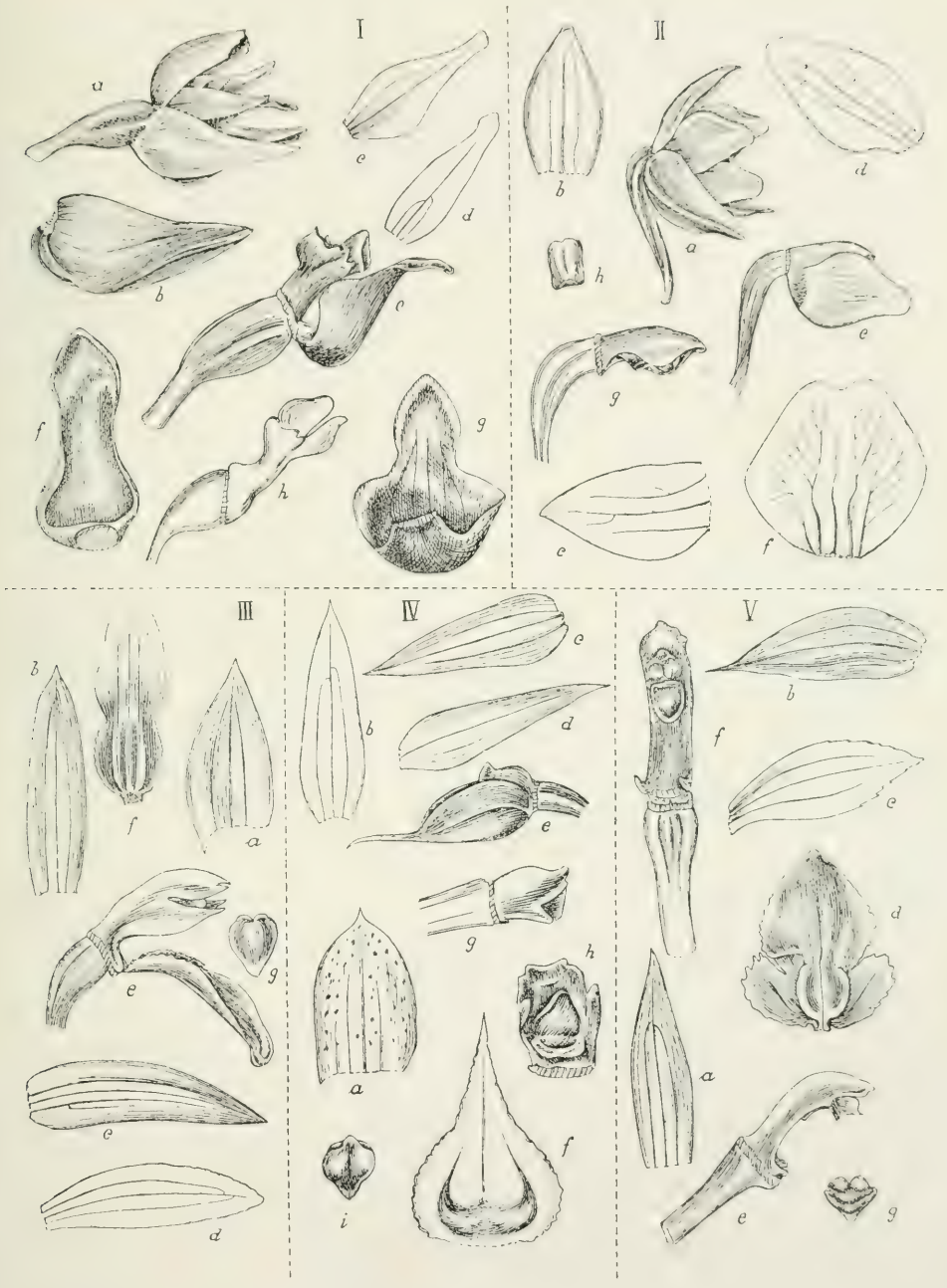

J. J. SMITH, del.

Tab. 31.

I. **Dendrochilum pallideflavens** Bl. J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 13.

a. Blüte $^{7}/_{2}$.
b. Unpaares Sepalum $^{9}/_{2}$.
c. Paariges Sepalum $^{6}/_{1}$.
d. Petalum $^{7}/_{1}$.
e. Lippe und Säule $^{17}/_{2}$.
f. Lippe $^{13}{}_{1}$.
g. Säule von unten $^{13}/_{1}$.

II. **Tainia elongata** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 18.

a. Blüte $^{7}/_{5}$.
b. Unpaares Sepalum $^{5}/_{3}$.
c. Paariges Sepalum $^{3}/_{2}$.
d. Petalum $^{3}/_{2}$.
e. Lippe und Säule $^{2}/_{1}$.
f. Lippe ausgebreitet $^{2}/_{1}$.
g. Anthere $^{11}/_{2}$.
h. Pollinarium $^{22}/_{3}$.

III. **Oberonia nitidicauda** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 15.

a. Braktee $^{12}/_{1}$.
b. Blüte $^{13}/_{1}$.
c. Unpaares Sepalum $^{13}/_{1}$.
d. Paariges Sepalum $^{13}/_{1}$.
e. Petalum $^{25}/_{2}$.
f. Lippe $^{15}/_{1}$.
g. Säule $^{16}/_{1}$.
h. Anthere $^{14}/_{1}$.

IV. **Oberonia cirrhifera** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 263.

a. Pflanze $^{3}/_{5}$.
b. Braktee $^{11}/_{1}$.
c. Blüte $^{13}/_{1}$.
d. Unpaares Sepalum $^{14}/_{1}$.
e. Paariges Sepalum $^{14}/_{1}$.
f. Petalum $^{14}/_{1}$.
g. Lippe $^{13}/_{1}$.
h. Säule $^{20}/_{1}$.
i. Anthere $^{28}/_{1}$.

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J. J. SMITH, del.

I. **Oberonia anceps** LNDL. J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 18.
a. Braktee $^{11}/_{1}$.
b. Blüte $^{12}/_{1}$.
c. Unpaares Sepalum $^{15}/_{1}$.
d. Paariges Sepalum $^{16}/_{1}$.
e. Petalum $^{17}/_{1}$.
f. Lippe $^{25}/_{2}$.
g. Anthere $^{33}/_{1}$.

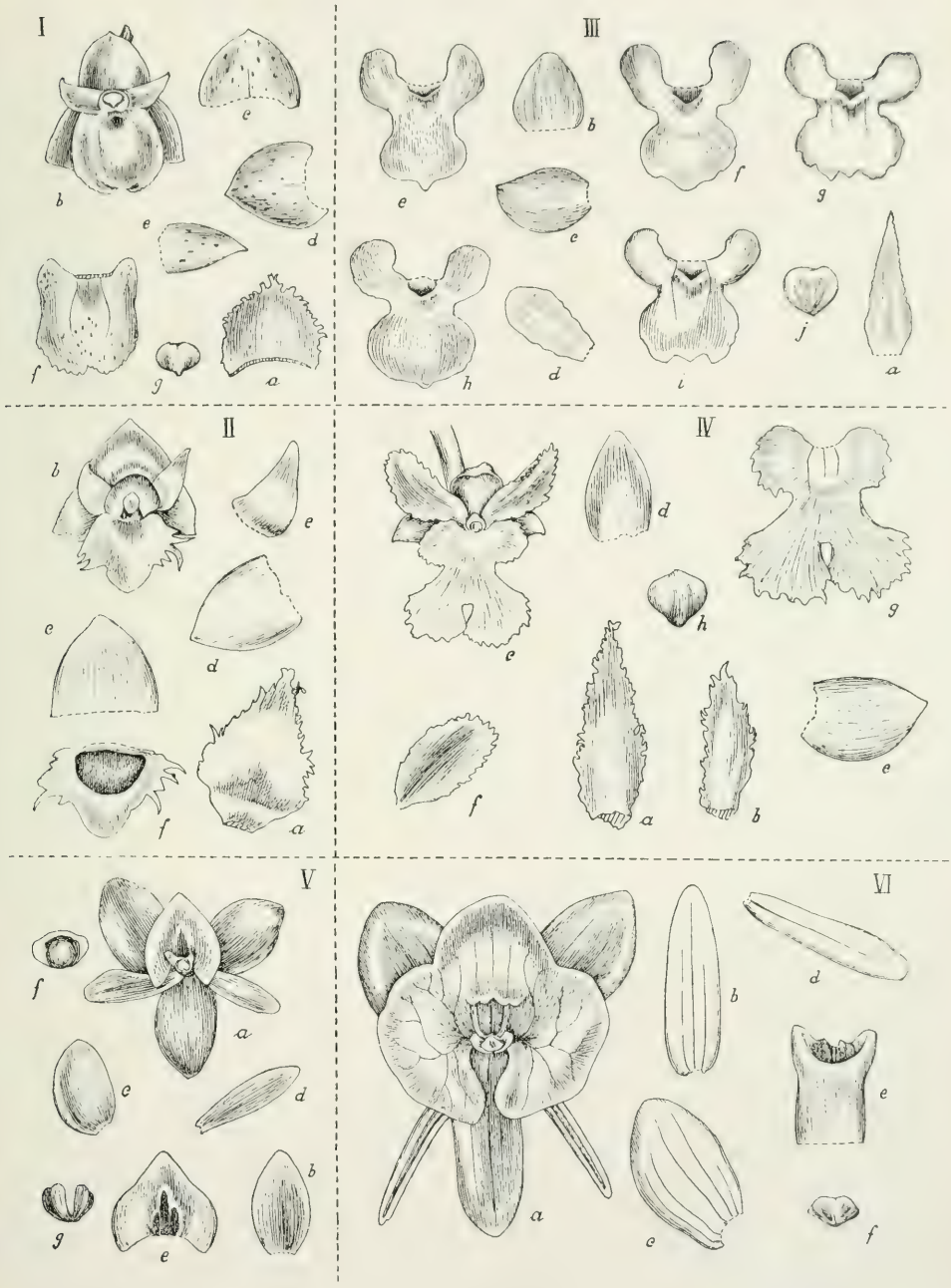
II. **Oberonia indragiriensis** SCHLTR. var. **javanica** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 266.
a. Braktee $^{15}/_{1}$.
b. Blüte $^{14}/_{1}$.
c. Unpaares Sepalum $^{19}/_{1}$.
d. Paariges Sepalum $^{21}/_{1}$.
e. Petalum $^{19}/_{1}$.
f. Lippe $^{21}/_{1}$.

III. **Oberonia tjisokanensis** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 267.
a. Braktee $^{8}/_{1}$.
b. Unpaares Sepalum $^{11}/_{1}$.
c. Paariges Sepalum $^{13}/_{1}$.
d. Petalum $^{13}/_{1}$.
e—i. Lippen $^{13}/_{1}$.
j. Anthere $^{23}/_{1}$.

IV. **Oberonia subligaculifera** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 35.
a, b. Brakteen $^{9}/_{1}$.
c. Blüte $^{9}/_{1}$.
d. Unpaares Sepalum $^{12}/_{1}$.
e. Paariges Sepalum $^{11}/_{1}$.
f. Petalum $^{10}/_{1}$.
g. Lippe $^{19}/_{2}$.
h. Anthere $^{32}/_{1}$.

V. **Microstylis tenggerensis** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 28.
a. Blüte $^{16}/_{3}$.
b. Unpaares Sepalum $^{9}/_{2}$.
c. Paariges Sepalum $^{9}/_{2}$.
d. Petalum $^{6}/_{1}$.
e. Lippe $^{6}/_{1}$.
f. Anthere $^{31}/_{2}$.
g. Pollinarium $^{31}/_{2}$.

VI. **Microstylis lobatocallosa** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 20.
a. Blüte $^{5}/_{1}$.
b. Unpaares Sepalum $^{15}/_{4}$.
c. Paariges Sepalum $^{3}/_{1}$.
d. Petalum $^{4}/_{1}$.
e. Säule von oben $^{25}/_{3}$.
f. Anthere $^{10}/_{1}$.



J. J. SMITH, del.

TAB. 33.

I. **Microstylis tjiwideiensis** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 38.
   a. Blüte $^{5}/_{1}$.
   b. Unpaares Sepalum $^{19}/_{3}$.
   c. Paariges Sepalum $^{6}/_{1}$.
   d. Petalum $^{7}/_{1}$.
   e. Lippe $^{7}/_{1}$.
   f. Anthere $^{16}/_{1}$.

II. **Microstylis purpureonervosa** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 20.
   a. Paariges Sepalum $^{22}/_{3}$.
   b. Petalum $^{8}/_{1}$.
   c. Lippe $^{6}/_{1}$.
   d. Säule $^{8}/_{1}$.
   e. Anthere $^{12}/_{1}$.

III. **Microstylis soleiformis** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XIII (1907), 24.
   a. Blüte $^{17}/_{2}$.
   b. Unpaares Sepalum $^{5}/_{1}$.
   c. Paariges Sepalum $^{6}/_{1}$.
   d. Petalum $^{11}/_{2}$.
   e. Lippe und Säule von der Seite $^{4}/_{1}$.
   f. Lippe ausgespreizt $^{4}/_{1}$.
   g. Säule von oben $^{8}/_{1}$.

IV. **Microstylis slamatensis** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 40.
   a. Blüte $^{23}/_{4}$.
   b. Unpaares Sepalum $^{15}/_{2}$.
   c. Paariges Sepalum $^{19}/_{4}$.
   d. Petalum $^{12}/_{1}$.
   e. Lippe $^{10}/_{1}$.
   f. Säule $^{11}/_{1}$.
   g. Anthere $^{17}/_{1}$.

V. **Microstylis cuprea** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 22.
   a. Unpaares Sepalum $^{6}/_{1}$.
   b. Paariges Sepalum $^{6}/_{1}$.
   c. Petalum $^{6}/_{1}$.
   d. Lippe $^{15}/_{2}$.
   e. Säule $^{7}/_{1}$.
   f. Anthere $^{18}/_{1}$.
   g. Pollinien $^{15}/_{1}$.

VI. **Microstylis longidens** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 25.
   a. Blüte $^{11}/_{3}$.
   b. Unpaares Sepalum $^{28}/_{5}$.
   c. Paariges Sepalum $^{17}/_{3}$.
   d. Petalum $^{17}/_{3}$.
   e. Lippe $^{13}/_{2}$.
   f. Anthere $^{11}/_{1}$.
   g. Pollinarium $^{11}/_{1}$.

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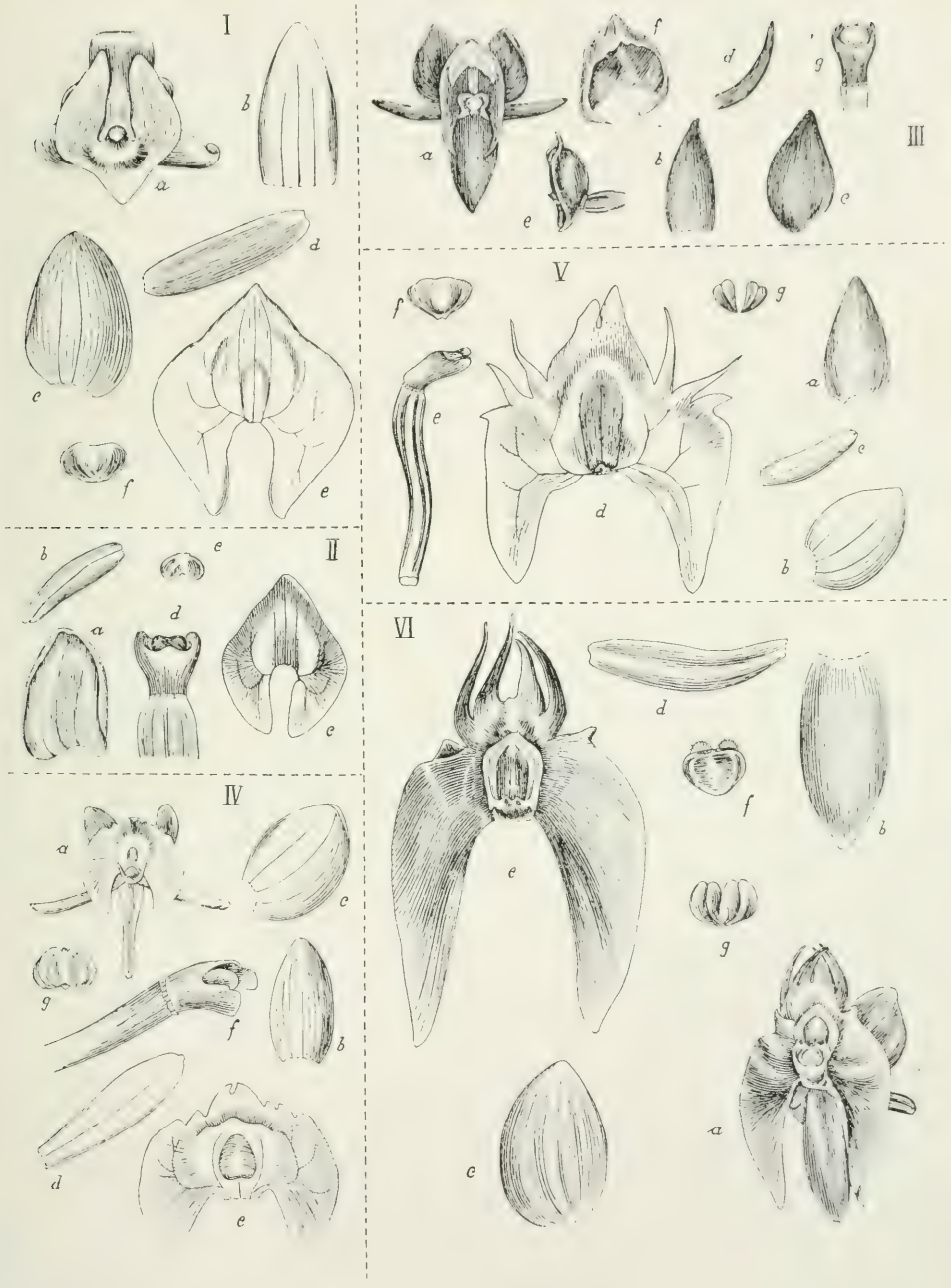

J. J. SMITH, del.

Tab. 34.

I. **Microstylis foetida** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 28.
- a. Blüte $^{6}/_{1}$.
- b. Unpaares Sepalum $^{13}/_{3}$.
- c. Paariges Sepalum.
- d. Petalum $^{23}/_{5}$.
- e. Lippe $^{13}/_{2}$.
- f. Säule $^{17}/_{2}$.
- g. Anthere $^{10}/_{1}$.
- h. Pollinien $^{51}/_{2}$.

II. **Liparis javanica** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 46.
- a. Pflanze $^{2}/_{3}$.
- b. Braktee $^{9}/_{1}$.
- c. Blüte $^{11}/_{5}$.
- d. Unpaares Sepalum $^{15}/_{4}$.
- e. Paariges Sepalum $^{9}/_{2}$.
- f. Petalum $^{9}/_{2}$.
- g. Lippe $^{11}/_{4}$.
- h. Anthere $^{19}/_{2}$.
- i. Pollinien $^{16}/_{1}$.
- j. Säule $^{9}/_{2}$.

III. **Liparis prianganensis** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 43.
- a. Blüte $^{2}/_{1}$.
- b. Unpaares Sepalum $^{11}/_{3}$.
- c. Paariges Sepalum $^{12}/_{5}$.
- d. Petalum $^{5}/_{2}$.
- e. Lippe und Säule $^{13}/_{5}$.
- f. Lippe $^{5}/_{2}$.
- g. Anthere $^{6}/_{1}$.

IV. **Liparis viridiflora** Lndl. J. J. S. in Fl. Buit. V, Orch. (1905), 268.
- a. Blüte $^{6}/_{1}$.
- b. Unpaares Sepalum $^{7}/_{1}$.
- c. Paariges Sepalum $^{8}/_{1}$.
- d. Petalum $^{10}/_{1}$.
- e. Lippe $^{10}/_{1}$.
- f. Säule $^{17}/_{2}$.
- g. Anthere $^{20}/_{1}$.

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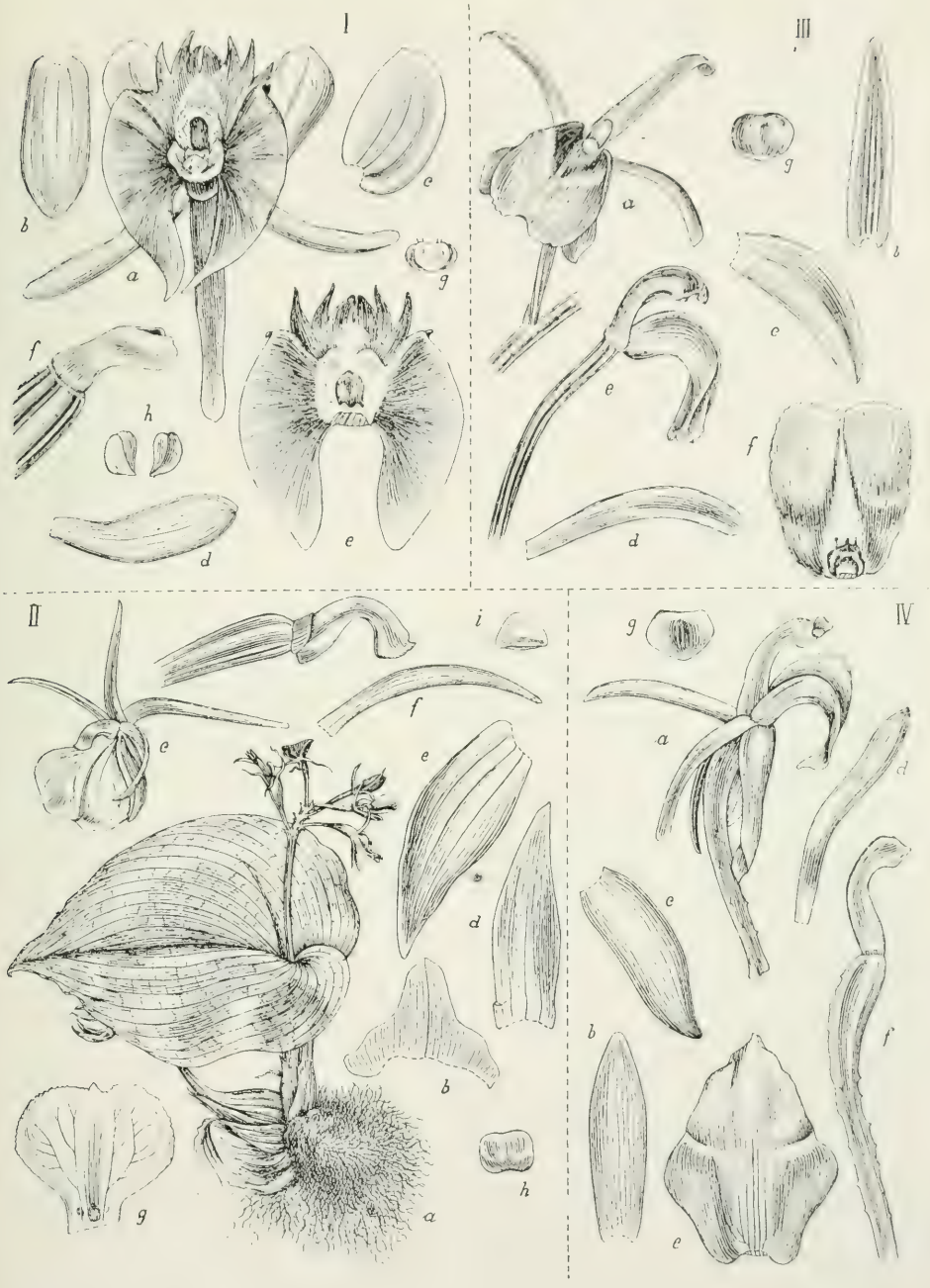

J. J. SMITH, del.

Tab. 35.

I. **Liparis Wightiana** Thw. J. J. S. in Bull. Dép. Agric, Ind. Néerl. XLIII (1910), 33.
   a. Unpaares Sepalum $^{5}/_{1}$.
   b. Paariges Sepalum $^{6}/_{1}$.
   c. Petalum $^{6}/_{1}$.
   d. Lippe $^{23}/_{4}$.
   e. Säule $^{13}/_{2}$.

II. **Liparis rhodochila** Rolfe. J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 34.
   a. Blüte $^{4}/_{1}$.
   b. Unpaares Sepalum $^{3}/_{1}$.
   c. Paariges Sepalum $^{3}/_{1}$.
   d. Petalum $^{3}/_{1}$.
   e. Lippe ausgebreitet $^{18}/_{5}$.
   f. Säule $^{5}/_{1}$.

III. **Liparis rhombea** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 35.
   a. Lippe und Säule von vorn $^{4}/_{1}$.
   b. Blüte von der Seite $^{4}/_{1}$.
   c. Unpaares Sepalum $^{13}/_{4}$.
   d. Paariges Sepalum $^{4}/_{1}$.
   e. Petalum $^{9}/_{2}$.
   f. Lippe ausgelegt $^{17}/_{5}$.
   g. Anthere $^{29}/_{2}$.

IV. **Liparis bicornuta** Schltr. J. J. S. in Bull. Dép. Agric. Ind. Néerl. XIII (1907), 27.
   a. Blüte $^{10}/_{3}$.
   b. Unpaares Sepalum $^{4}/_{1}$.
   c. Paariges Sepalum $^{4}/_{1}$.
   d. Petalum $^{4}/_{1}$.
   e. Lippe und Säule $^{11}/_{2}$.
   f. Lippe ausgebreitet $^{5}/_{1}$.

V. **Liparis speculifera** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 49.
   a. Blüte $^{4}/_{1}$.
   b. Unpaares Sepalum $^{19}/_{4}$.
   c. Paariges Sepalum $^{19}/_{4}$.
   d. Petalum $^{6}/_{1}$.
   e. Lippe von oben $^{6}/_{1}$.
   f. Lippe von unten $^{6}/_{1}$.
   g. Säule von der Seite $^{27}/_{4}$.
   h. Säule von unten $^{6}/_{1}$.
   i. Anthere $^{11}/_{1}$.

VI. **Liparis angustiflora** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 31.
   a. Blüte $^{14}/_{3}$.
   b. Unpaares Sepalum $^{13}/_{3}$.
   c. Paariges Sepalum $^{9}/_{2}$.
   d. Petalum $^{6}/_{1}$.
   e. Lippe und Säule $^{16}/_{3}$.
   f. Lippe $^{15}/_{2}$.
   g. Säule von unten $^{10}/_{1}$.
   h. Anthere $^{10}/_{1}$.

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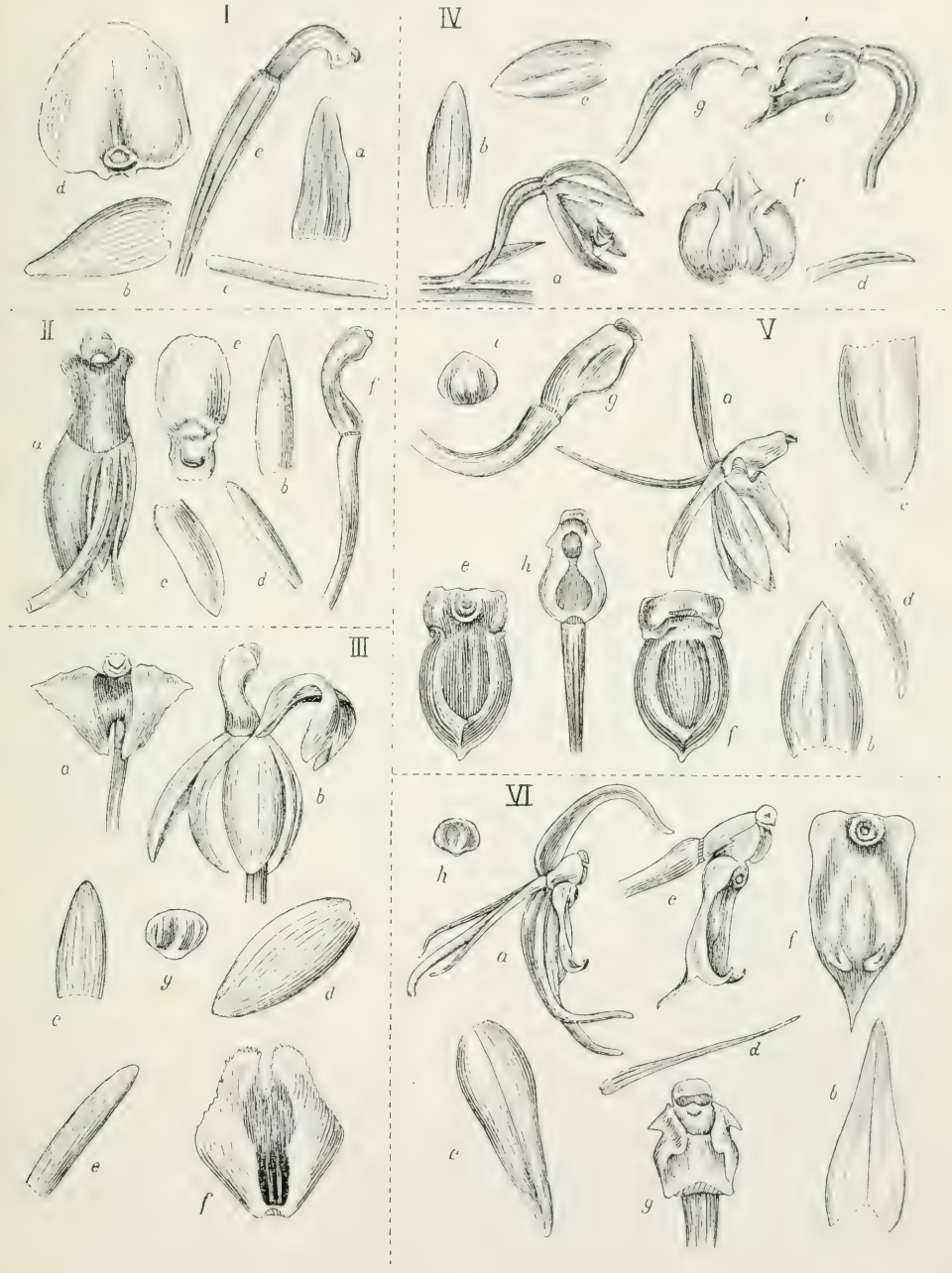

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Tab. 36.

I. **Agrostophyllum tenue** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. XXVI (1918), 33.

a. Unpaares Sepalum $^{13}/_{3}$.
b. Paarige Sepalen $^{11}/_{2}$.
c. Petalum $^{6}/_{1}$.
d. Lippe und Säule $^{6}/_{1}$.
e. Längsschnitt der Lippe $^{6}/_{1}$.
f. Säule $^{14}/_{3}$.
g. Anthere $^{8}/_{1}$.
h. Pollinarium $^{12}/_{1}$.

II. **Agrostophyllum longifolium** Rchb. F. J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 274.

a. Unpaares Sepalum $^{4}/_{1}$.
b. Paariges Sepalum $^{9}/_{2}$.
c. d. Petalen $^{5}/_{1}$ und $^{14}/_{3}$.
e. Lippe und Säule $^{5}/_{1}$.
f. Lippe ausgebreitet $^{20}/_{3}$.
g. Säule $^{6}/_{1}$.
h. Anthere $^{13}/_{2}$.

III. **Agrostophyllum Denbergeri** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 277.

a. Blüte $^{5}/_{1}$.
b. Unpaares Sepalum $^{9}/_{2}$.
c. Paariges Sepalum $^{17}/_{3}$.
d, e. Petalen $^{6}/_{1}$.
f. Lippe und Säule $^{7}/_{1}$.
g. Lippe ausgebreitet $^{9}/_{1}$.
h. Säule $^{7}/_{1}$.
i. Anthere $^{11}/_{1}$.

IV. **Agrostophyllum latilobum** J. J. S. in Bull. Jard. Bot. Buit. 3e sér. III (1921), 281.

a. Unpaares Sepalum $^{8}/_{3}$.
b. Paariges Sepalum $^{9}/_{2}$.
c. Petalum $^{14}/_{3}$.
d. Lippe und Säule $^{9}/_{2}$.
e. Lippe ausgebreitet $^{16}/_{3}$.
f, g. Säule von der Seite $^{9}/_{2}$.
h. Säule von unten $^{11}/_{2}$.
i. Anthere $^{8}/_{1}$.
j. Pollinarium $^{11}/_{1}$.

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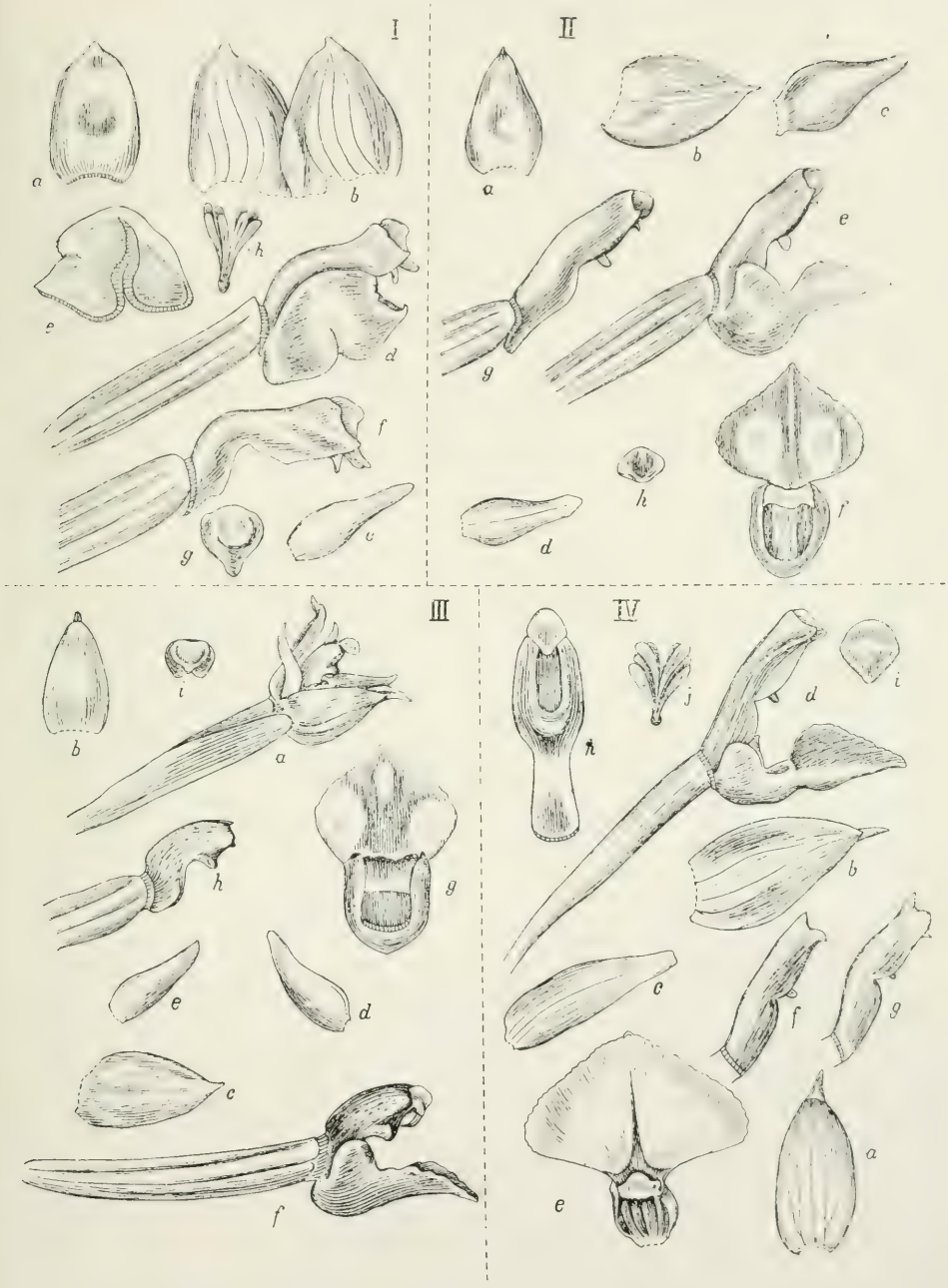

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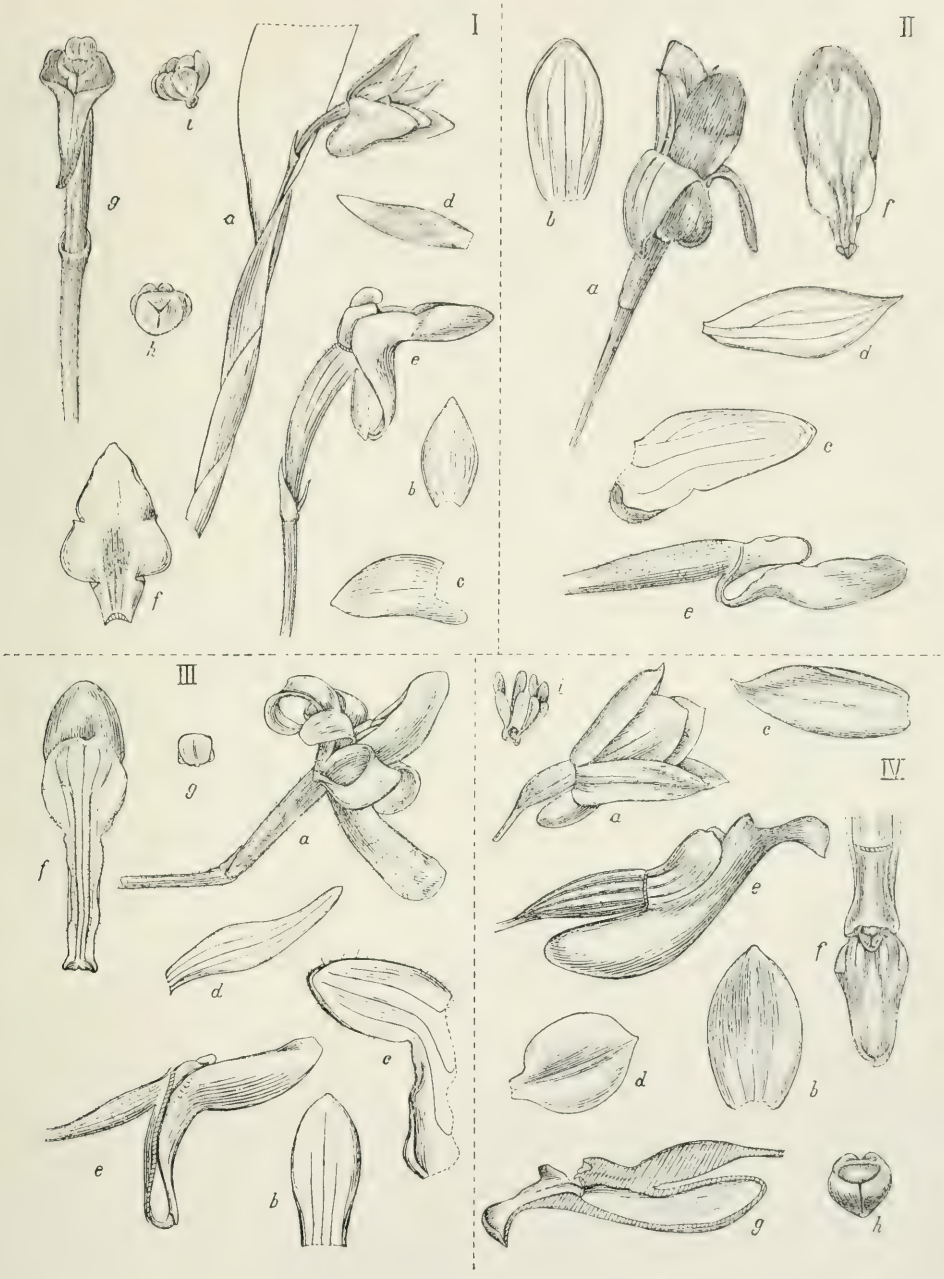
Tab. 37.

I. **Ceratostylis brevibrachiata** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 38.
- a. Blüte $^{2}/_{1}$.
- b. Unpaares Sepalum $^{2}/_{1}$.
- c. Paariges Sepalum $^{7}/_{3}$.
- d. Petalum $^{3}/_{1}$.
- e. Lippe und Säule $^{7}/_{1}$.
- f. Lippe ausgebreitet $^{15}/_{4}$.
- g. Säule von unten $^{4}/_{1}$.
- h. Anthere $^{6}/_{1}$.
- i. Pollinarium $^{7}/_{1}$.

II. **Ceratostylis crassifolia** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 54.
- a. Blüte $^{10}/_{3}$.
- b. Unpaares Sepalum $^{7}/_{2}$.
- c. Paariges Sepalum $^{15}/_{4}$.
- d. Petalum $^{9}/_{2}$.
- e. Lippe und Säule $^{13}/_{4}$.
- f. Lippe ausgebreitet $^{18}/_{5}$.

III. **Ceratostylis Backeri** J. J. S. in Bull. Jard. Bot. Buit. 2e sér. IX (1913), 52.
- a. Blüte $^{10}/_{3}$.
- b. Unpaares Sepalum $^{10}/_{3}$.
- c. Paariges Sepalum $^{4}/_{1}$.
- d. Petalum $^{14}/_{3}$.
- e. Lippe und Säule $^{11}/_{3}$.
- f. Lippe ausgebreitet $^{4}/_{1}$.
- g. Anthere $^{7}/_{1}$.

IV. **Calanthe salaccensis** J. J. S. in Bull. Dép. Agric. Ind. Néerl. XLIII (1910), 21.
- a. Blüte $^{4}/_{3}$.
- b. Unpaares Sepalum $^{3}/_{2}$.
- c. Paariges Sepalum $^{3}/_{2}$.
- d. Petalum $^{7}/_{5}$.
- e. Lippe und Säule von der Seite $^{5}/_{2}$.
- f. Dieselben von oben $^{3}/_{1}$.
- g. Längsschnitt der Lippe $^{7}/_{3}$.
- h. Anthere $^{6}/_{1}$.
- i. Pollinarium $^{6}/_{1}$.



J. J. SMITH, del.

„'S LANDS PLANTENTUIN"
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STICKSTOFFREICHE MILCHSÄFTE

von

A. J. Ultée.

Es gibt mehrere Milchsäfte, wovon der Hauptbestandteil der Trockensubstanz aus Kautschuk besteht; bei sehr vielen Milchsäften treten acetonlösliche Bestandteile (s. g. Härze und Wachse) an die erste Stelle; einige Milchsäfte sind bekannt, welche reich an Gerbstoffen sind. Mit mehr oder weniger Recht kann man alle diese Substanzen als Sekrete betrachten.

Es wäre sicher interessant, wenn es Milchsäfte gäbe, die eine grosse Quantität von Stoffen enthielten, deren die Pflanzen nicht so indifferent gegenüber stehen, z. B. Eiweissstoffe.

Der Stickstoffgehalt von mehreren Milchsäften ist freilich bestimmt worden, doch gewöhnlich hat man niedrige Werte gefunden. Als Regel hat man angenommen, dass dieses Element nur als Eiweiss-Stickstoff anwesend sei. Dann enthält *Hevea*-latex 1—2 % Eiweiss, *Manihot glaziovii* Milchsaft, der stickstoffreichste, dem ich in der Literatur begegnete, rund 6 % Eiweiss.

Zwar giebt Weber [1]) an, er habe in *Castilloa*-Milch etwa 8 % Eiweiss gefunden, aber diese Zahl stimmt nicht mit den Resultaten von anderen Untersuchern überein. Nach einer Analyse von van Romburgh [2]) ist in diesem Saft nur 0.36 % Stickstoff (2.25 % Eiweiss) vorhanden, ich selber fand im Milchsaft von einem sehr alten Baum 0.48 % Stickstoff, 3 % Eiweiss also.

De Jong und Tromp de Haas [3]) haben bei ihren Untersuchungen von *Castilloa*-Milch ganz andere Resultate als Weber bekommen, einiges Misstrauen, was die Eiweissbestimmung betrifft, ist also nicht unbegründet.

Molisch [4]) hat bei einer mikrochemischen Arbeit im Milchsaft von zwei Moraceen *Cecropia peltata* L. und *Brosimum microcarpum* Schott. „eine Unmasse von Proteinkörnern" constatiert, eine Stickstoffbestimmung aber nicht ausgeführt.

Cecropia peltata ist im botanischen Garten zu Buitenzorg aanwesend, beim Zapfen von dem Stamme dieses Baumes fliesst aber so gut wie kein Saft heraus. Molisch hat die beim Verletzen der Stengel und Blattstiele heraustretenden wassrigen Tröpfchen gesammelt; es wäre aber schwer, auf diese Weise genügend Saft für eine makrochemische Untersuchung zu bekommen.

---

[1]) Ber. *36*, 3108, (1903).
[2]) Mededeelingen uit 's Lands Plantentuin. XXXIX, 78; (1900).
[3]) Ber. *37*, 3298; (1904).
[4]) Studien über den Milchsaft und den Schleimsaft der Pflanzen, 21; (1901).

Brosimum microcarpum ist im Garten alhier nicht angepflanzt, wohl einige andere Brosimum-Arten, kleine Bäume, die nur eine geringe Menge Saft liefern dürften.

Bei einer grossen Zahl anderer Moraceen, die beim Zapfen reichlichen Saft gaben, habe ich Stickstoffbestimmungen ausgeführt. Der frisch gesammelte Saft wurde dazu erst auf dem Wasserbade eingedampft und bei 105° im Trockenschrank bis zu constantem Gewicht getrocknet. Hierunten habe ich nun einige Säfte angetroffen, die viel reicher an Stickstoff waren als die bis jetzt untersuchten. Nur diese abnormalen Säfte sind in der untenstehenden Tabelle aufgenomen.

Dr. SMITH, Direktor des Herbariums am botanischen Garten (Buitenzorg) war so freundlich die Determination der Bäume zu kontrolieren.

MILCHSAFT VON	Trocken-subztanz in %	Stickstoff in Trockensub-stanz in %	Stickstoff in Saft in %
1. Artocarpus integra Merr. . .	24.09	5.10	1.23
2. Antiaris toxicaria Lesch. . .	26.42	5.20	1.37
3. Broussonetia papyrifera Vent.	36.55	4.49	1.63
4. Ficus cordifolia Bl.	25.76	12.72	3.28
5. Ficus callosa Willd.	29.27	14 52	4 25

Nimmt man an, was man als Regel tut, aber nicht sicher ist, dass der gesamte Stickstoff Eiweiss-Stickstoff ist, dann ist resp. 7.69, 8.56, 10.25, 20.48 und 26.56% Eiweiss im Saft vorhanden, im Trockensubstanz 31 87, 32.50, 28 06, 79.50 und 90.75% Eiweiss.

Jedenfalls sind solche hohe Stickstoffgehalte, im besonderen von den beiden Ficus-Arten, sehr merkwürdig.

Die ersten drei Milchsäfte der Tabelle, die viel s. g. Härze enthalten, sind stark milchig, der Saft von *Ficus cordifolia* ist noch deutlich trübe, der Saft von *Ficus callosa* sieht wie eine Gummi arabicum-Lösung aus. Alle diese Milchsäfte sind arm an Kautschuck oder ganz frei davon.

Es gibt aber viele kautschukarme Milchsäfte von Moraceen, die auch arm an Stickstoff sind. Der Saft von *Ficus fulva* z. B. enthält nur wenig Stickstoff (0.26%) der von *Artocarpus communis Forst.* nur 0 32%.

Zwischen nahe verwandten Pflanzen, wie *Artocarpus integra* und *Artocarpus communis* gibt es also, was dem Stickstoffgehalt betrifft, grosse ünterschiede.

Auf eine Eigentümlichkeit soll hier noch hingewiesen werden: die stickstoffreichen Milchsäfte sind schwer durch Alkohol zu coagulieren. Bei Artocarpus integra gelingt das überhaupt nicht, dagegen gerinnt der Milchsaft von Artocarpus communis, der nicht reich an Stickstoff ist, spielend leicht.

BEITRÄGE ZUR PILZFLORA VON NIEDERLÄNDISCH INDIEN.

von

DR. C. VAN OVEREEM.

Vorwort.

Die Erforschung der Pilzflora von Niederländisch Indien steht noch zu sehr im Anfangsstadium, als dass es jetzt schon möglich wäre, sie familien- oder gattungsweise zu bearbeiten. Die Ergebnisse können vorläufig nur als Fragmente, also ohne irgendwelchen Zusammenhang, publiziert werden.

Diese Beiträge darf man als eine Fortsetung der Veröffentlichungen von VON HÖHNEL über die Javanische Pilzflora in den Sitzungsberichten der Akademie von Wien betrachten. Bei der Zusammenstellung haben wir immer diese mustergültigen Arbeiten vor Augen gehabt und die Diagnosen möglichst so ausführlich wie dort gemacht. Die Zeiten, dass man noch mit einer lateinischen Diagnose von einigen Worten zufrieden war, wie HENNINGS das in der Monsunia gemacht hat, sind vorbei.

In Gegenstellung mit den Arbeiten von VON HÖHNEL hoffen wir unsere Beiträge so viel wie möglich zu illustrieren. Obschon viele Gruppen, wie *Pyrenomyceten*, *Imperfecten* u. s. w. von Spezialforschern in Europa bearbeitet werden, gibt es doch auch in diesen Gruppen viele Sachen, welche nur an Ort und Stelle untersucht werden können. Auch diese Ergebnisse sind in diese Beiträge eingetragen.

---

1. Ueber Chondromyces aurantiacus (BERKELEY et CURTIS) THAXT.

Im botanischen Garten in Buitenzorg fand ich auf faulenden Kegeln von *Zamia muricata* einen *Chondromyces*, welchen ich zu obenstehender Art bringe, obschon einige kleine Abweichungen zu beobachten waren. Die Art ist für Java nicht neu. Sie wurde schon von QUEHL (Centralbl für Bakt. u. s w. zweite Abt. Bd. XXI, 1906) auf aus Java mitgebrachtem Mist in Berlin gezüchtet. Im Substrat ist sie nicht wählerisch, denn sie ist ausser auf Mist auch auf faulenden Pilzen, Flechten und Holz gefunden worden.

Das Material auf den Zamiakegeln war reichlich vorhanden, aber überall war der Habitus im Grossen und Ganzen derselbe.

Die Cystophoren sind 250—450 μ hoch, unverzweigt oder im oberen Teil bis drei Mal gegabelt, wobei die Aeste erst dünner (bis 5—9 μ), schliesslich aber wieder etwas angeschwollen werden und in zahlreiche, kurze, spitze, kegelförmige Ausläufer ausgezogen sind. Ihre Farbe ist orange bis schmutzigbraun, also etwas dunkler wie meistens angegeben wird, immer intensiver als die der Köpfchen.

Die Stammstructur zeigt eine feine Längsstreifung. Zahl und Farbe der Cysten stimmt völlig mit der Beschreibung der Art. Die Farbe der Cysten ist deutlich hell orange, was grösstenteils von ihrem Inhalt hervorgerufen wird, denn die Membran selbst ist schmutzig hell gelb. Ihre Grösse war aber viel niedriger (17—23 × 9,2—16 μ), während man für ihre Länge 25—50 μ angegeben findet (THAXTER, QUEHL). Nur ZUKAL (Ber. d. Deutschen Bot. Gesellsch. XIV 1896 p. 340) gibt für eine Form an 11—12 × 22 μ. Ihre Form ist länglich eiförmig mit abgerundeten Ecken, an der Basis manchmal etwas abgeplattet, sogar bei der Sterigmenanheftung etwas zurückgebogen. Meistens bleibt ein Teil dieses Stielchens an der Cyste erhalten. Diese Merkmale werden von QUEHL nicht deutlich hervorgehoben, sodass eine Verwechselung mit verwandten Arten (*Ch. crocatus*) möglich ist.

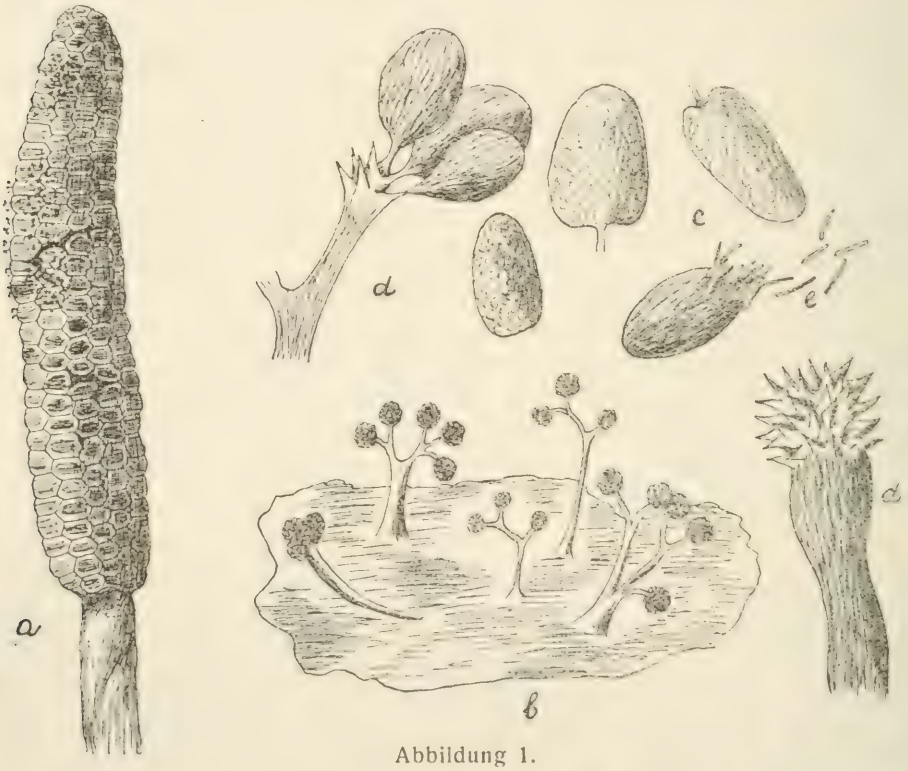


Abbildung 1.

Die Stäbchen im Inneren sind farblos, in Masse sehr hell orangegelb und länger wie angegeben wird (3,5—8 μ).

Abschon die Stäbchenlänge, Cystengrösse und Stielfarbe etwas abweichen, stimmen die anderen Merkmale genügend, um eine Identifizierung zu gestatten, denn ZUKALL (l.c.) hat gezeigt, wie ausserordentlich variabel diese Art sein kann.

Erklärung zu Abbildung 1:

a. Fruchtkörper, nat. Gr.
b. „ 45/1
c. Cysten 800/1
d. Köpfchen mit Sterigmen 800/1
e. Stäbchen 800/1.

2. **Nectriella** (*Cryptonectriella*) **Geoglossi** V. OVEREEM n. sp.

Diese Art wurde von mir zufälligerweise bei der Untersuchung der Wirtspflanze, *Geoglossum Walteri* BERK., entdeckt. Sie scheint mir eine seltene Erscheinung zu sein, denn obschon die *Geoglossum*-Art hier zu den häufigsten grösseren *Ascomyceten* gehört, wurde sie bis jetzt nie wiedergefunden.

Die *Geoglossum*-Exemplare wuchsen zahlreich im Bambusa-Gebüsch des hiesigen botanischen Gartens zwischen Moosen und Bambusa-Wurzeln an einer feuchten Stelle. Nur wenige Exemplare waren vom Parasiten befallen. Makroskopisch war nichts besonders am Hymenium der Wirtspflanze zu beobachten. In Querschnitten der *Geoglossum*-Pflanze sieht man die Perithecien des Parasiten hier und da im Hymenium fast ganz eingesenkt. Irgendwelche Schädigung fehlte vollständig. An der Stelle, wo ein Perithecium liegt, weichen Asci und Paraphysen etwas auseinander. Auch von einer Desorganisation des inneren Gewebes war nichts zu beobachten.

Die Perithecien sind in allen Teilen farblos und hyalin, wodurch sie in den Präparaten wenig auffallen und eventuel darunterliegende Teile der Wirtspflanze (Sporen, Borsten) durchschimmern. Sie sind birnförmig, oben schwach verschmälert, abgerundet und ragen kaum mit ihrer Mündung etwas über das Hymenium hervor. Ihre Grösse wechselt zwischen 66×134 und 84×144 μ. Die Wand ist farblos, etwa 10 μ dick, aus einigen Schichten lose ineinander geflochtener Hyphen zusammengesetzt. Zu einer Pseudoparenchymbildung kommt es nicht Die Schläuche sind lang und dünn gestielt, 4,5—5,7 μ breit, pars sporif. etwa 30 μ lang, achtsporig. Die Sporen liegen zweireihig, sind farblos, mit oder ohne Öltropfen, oft etwas gekrümmt und einseitig zugespitzt, $8,6-14,9 \times 2,3-2,7$ μ, schliesslich zweizellig und wechseln sehr in ihrer Form Die Paraphysen sind dünn, fadenförmig, unverzweigt, mit kleinen Körnchen, bis 0,5 μ breit.

Als Hymeniumparasit ist von *Geoglossum* nach SACCARDO's Sylloge nur *Peckiella Geoglossi* (ELL. et EVERH.) SACC. auf *Geoglossum hirsutum* bekannt, welche von unserer Art völlig verschieden ist.

Die anatomischen Verhältnisse und Lebensweise sind im grossen und ganzen dieselben wie bei *Nectriella biparasitica* (VON HÖHNEL) WEESE. Sie passt gut in diese Gattung, wo sie als Parasit in der von VON HÖHNEL aufgestellten Sektion *Cryptonectriella* unterzubringen ist (Ann. mycol. XVI — 1918 p. 36).

Nectriella *(Cryptonectriella)* **Geoglossi** V. OVEREEM,

Perithecia in omnibus partibus non colorata, hyalina, piriformia, apicem versus obtuse subattenuata, e hymenio hospitis non vel vix exserta, $66\text{-}84 \times 134 - 144$ μ. Membrana perithecii $\pm$ 10 μ crassa, ex hyphis laxe permixtis composita.

Asci longe tenuiter pedicellati, 4,5 — 5,7 μ lati, octospora, parte sporifera 30 μ longa.

Sporae non coloratae, biseriales, $8,6 - 14,9 \times 2,3 - 2,7$ μ, variabilis, denique bicellulares, paraphysibus filiformibus simplicibus.

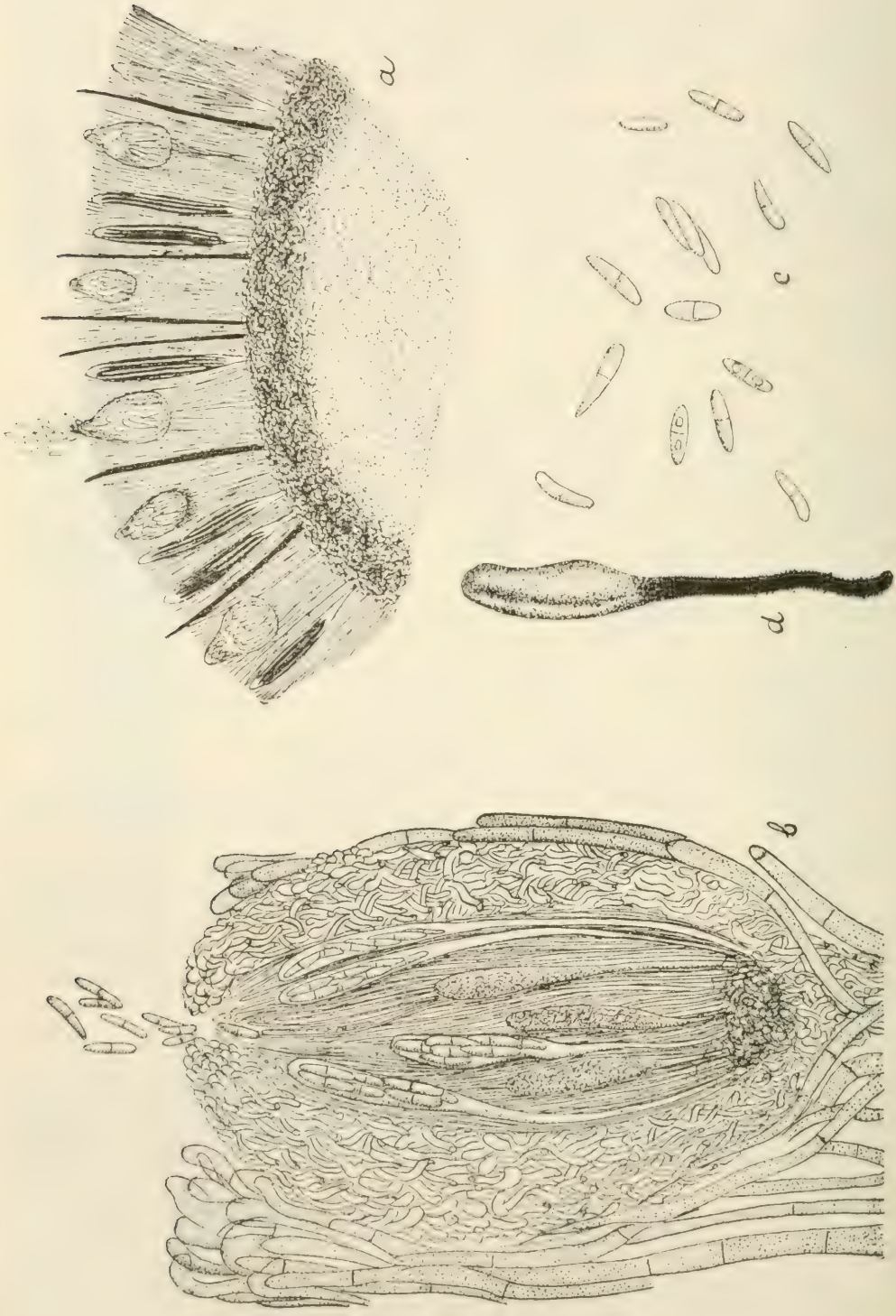


Abbildung 2.

In hymenio *Geoglossi Walteri* BERK. parasitica.
Hortus Bogoriensis, in bambuseto, 1921, leg. C. VAN OVEREEM.

Erklärung zu Abbildung 2:

a. Perithecien im Hymenium von *Geoglossum Walteri* BERK. 350/1.
b. Perithecium 850/1.
c. Sporen 850/1.
d. Fruchtkörper von *Geoglossum Walteri* BERK. nat. Gr.

3. Ueber eine Blattfleckenkrankheit von *Baccaurea javanica* (BL.) MÜLL. ARG.

Bei einem Exemplar von *Baccaurea javanica* (BL.). Müll. Arg. im hiesigen botanischen Garten sind die Blätter von einer Fleckenkrankheit befallen, welche von einem Pilz verursacht wird. Fast die meisten Blätter sind mehr oder weniger stark angegriffen. Weil das Exemplar einen ganz unnatürlichen Standort hat (es ist eine typische Urwaldpflanze, steht hier aber mitten auf einer Rasenfläche), ist es meiner Meinung nach nicht ganz ausgeschlossen, dass durch einen gewissen Schwächezustand die Krankheit hier so stark auftritt.

Zuerst entstehen kleine, hell grüngelbe, nicht scharf abgegrenzte Flecken, welche auf der dunkelgrünen Oberseite der Blätter sehr auffallen. Auch ziemlich junge Blätter werden befallen. Diese Flecken vergrössern sich, werden bald dunkelbraun, schliesslich in der Mitte wieder mehr hell schmutzigbraun, mit gelblichem Rande. Zonenbildung fehlt ganz. Die Fleckenform ist sehr verschieden, bald rundlich, bald unregelmässig und zusammenfliessend, manchmal den ganzen oberen Blatteil umfassend. Stark angegriffene Blätter fallen frühzeitig ab.

Die Perithecien findet man als kleine schwarze Pünktchen in der Mitte von alten Flecken unregelmässig zerstreut an der Oberseite der Blätter. Mit dem unbewaffneten Auge sind sie kaum zu sehen. Sie sind kugelförmig, oft etwas abgeplattet und nach oben etwas ausgezogen und verschmälert. Der Mund ragt kaum etwas über die Epidermis empor und ist abgerundet. Von einem deutlichen Ostiolum ist keine Rede. Sie sind 120 — 145 μ i. D., liegen hauptsächlich im Palissadenparenchym und berühren noch die oberen Schichten des Schwammparenchyms. In Figur 3a treten diese Verhältnisse deutlich hervor. Links sind die Zellen schon ganz desorganisiert und überall von Pilzhyphen durchsetzt. Rechts ist die eigentümliche Anordnung der Palissadenzellen um eine grosse Zelle, in deren Oberhälfte sich eine Linse (zweifellos für die Lichtkonzentration) entwickelt hat, noch deutlich zu beobachten. Das Schwammparenchym war fast völlig zerstört. Die Peritheciumwand ist aus einer äusseren farbigen und einer inneren farblosen Partie zusammengesetzt. Die äussere Partie besteht aus einer einzigen Zellschicht parenchymatischer, eckiger, abgeplatteter, bläulichschmutzigbrauner Zellen, etwa 4—7 μ i. D. Die innere Partie besteht aus einigen Schichten farbloser, abgeplatteter Zellen. Hieraus entspringen im basalen Teil des Peritheciums die Schläuche und Paraphysen, im oberen Teil kurze, scharf zugespitzte, etwas nach unten gebogene Haare.

Die Schläuche sind kurz gestielt, keulig, oben etwas verschmälert und abgerundet, 8—sporig, 60—70×9—12 μ. Pore ohne Jodreaction.

Paraphysen fadenförmig, unseptiert, zahlreich, über die Schäuche emporragend, mit kleinen Tröpfchen.

Sporen in den Schläuchen schief zweireihig liegend, farblos, einzellig, spindelförmig, an einem Ende mehr oder weniger deutlich abgerundet, meistens mit einem grossen zentralen und vielen kleinen, selten nur mit zahlreichen kleinen oder zwei grossen Oeltröpfchen, 15,5—19,5 × 3,5—5 μ.

Die Art passt gut in die Gattung *Physalospora* NIESSL und hat *Physalospora Baccaureae* VON OVEREEM zu heissen. Von der Wirtspflanze sind keine Pilze als Parasiten bis jetzt beschrieben worden.

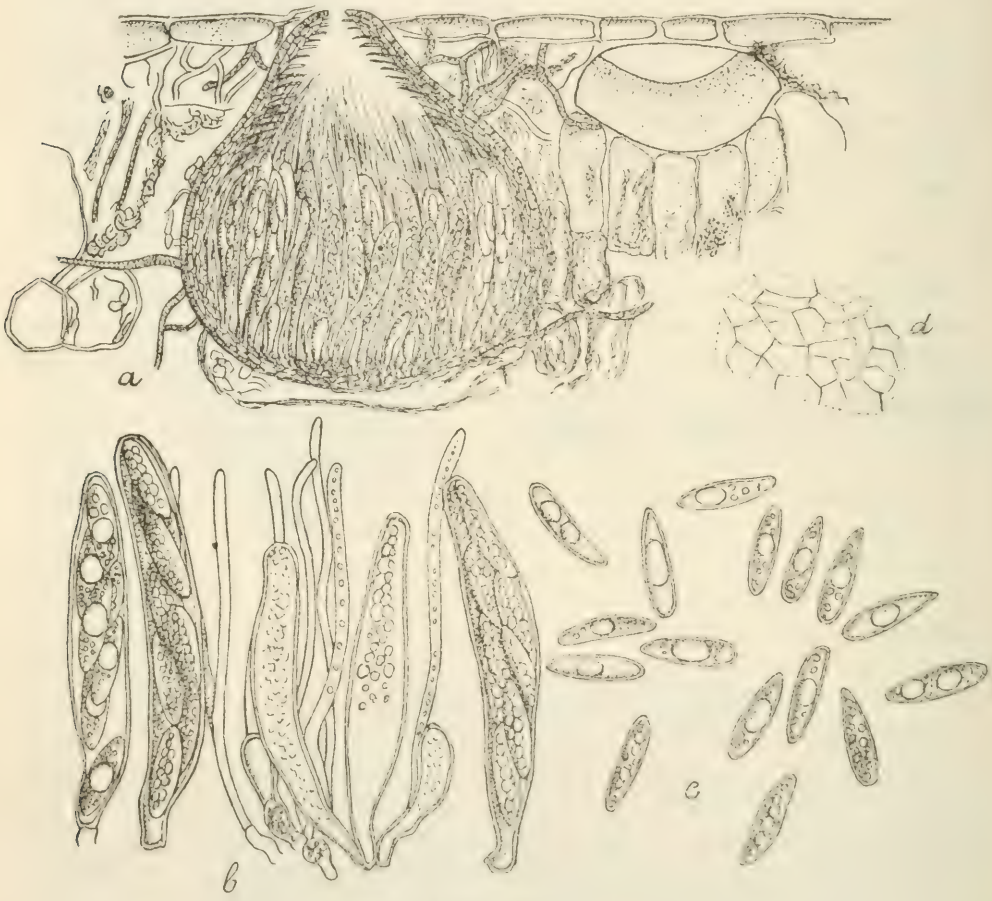


Abbildung 3.

Physalospora Baccaureae V. OVEREEM n. sp.

Perithecia epiphylla, in macularum fuscarum media parte sparsa, punctiformia, nigra, subglobosa, apicem versus pauce attenuata, 120—145μ i.d.

Ostiolum nullum. Membrana tenuis, strato cellularum exteriore pseudoparenchymatica glauco-fusca, stratis cellularum interioribus excolorata.

Asci breviter pedicellati, claviformes, apicem versus rotundato-attenuati, 8-spori, 60—70 × 9—11 μ, J-. Paraphysae filiformes eseptatae, numerosae,

ascis longiores. Sporae oblique biseriatae, hyalinae continuae fusiformes vel basi subrotundatae, 1-guttulatae, 15,5—19,5 × 3,5–5 μ.

In foliis *Baccaureae javanicae* (BL.) MÜLL. ARG. parasitica. Hortus bogoriensis leg. C. VAN OVEREEM.

Erklärung zu Abbildung 3:

a. Blattquerschnitt mit einem Perithecium 350/1
b. Asci und Paraphysen 850/1
c. Sporen 850/1
d. Zellen von der Aussenschicht der Wand 850/1

4. Ueber die von HOLTERMANN aufgestellten Arten *Calocera odorata* und *C. major*.

Zu den zahlreichen Formen, welche CARL HOLTERMANN in seinen "Mykologischen Untersuchungen aus den Tropen" als neu beschrieben hat, gehören obenstehende zwei *Calocera*-Arten. Die Beschreibungen sind schlecht, unvollständig und verwirrend und ohne die Abbildungen wäre es kaum möglich, herauszufinden, was vorgelegen hat. Zweifelsohne sind beide Arten identisch. Auch HOLTERMANN selbst gibt an, dass eigentlich kein Unterschied zwischen beiden Arten besteht; die Unterscheidung soll nur durch die Stellen, wo die Sporen gebildet werden, begründet sein. Wir können diese Bemerkung als wertlos unberücksichtigt lassen und es bleibt nichts anderes übrig, als den irreführenden ersten Namen odorata zu wählen, obschon dieser Art irgendein typischer Geruch gänzlich fehlt. Aus der Beschreibung von HOLTERMANN geht schon hervor, dass keine *Calocera* sondern eine *Guepinia* vorliegt, denn das Hymenium ist nur einseitig ausgebildet. Die Art hat also *Guepinia odorata* (HOLTERMANN) v. OVEREEM zu heissen. Ich lasse hier eine neue Beschreibung folgen, weil Grössenangaben der mikroskopischen Merkmale ganz fehlen und auch die Abbildungen unvollständig und z. T. unrichtig sind.

Fruchtkörper zerstreut aber häufiger zu zweien, bisweilen auch gehäuft oder zusammenfliessend, etwa 4 c.m. lang, nach HOLTERMANN auch viel grösser, bis 8 c.m., deutlich spatelförmig und gestielt, in allen Teilen schön orangefarbig. Stiel rund oder etwas kantig, vom Substrat schief abstehend, bis 1.5 cm. lang und 3—5 mm. dick, allmählich in den nicht deutlich abgegrenzten, mehr oder weniger regelmässig spatelförmigen, nach den Rand gleichmässig dünner werdenden, aufgebogenen Hut übergehend. Hut in der Mitte etwa $^3/_4$ cm dick, im Querschnitt schwach rosa, mit dem Hymenium nur an der Unterseite, welche direkt in das Stielgewebe übergeht, während an der Oberseite der Stiel sich noch über den Hutrand etwas fortsetzt

Basidien farblos, mit zwei grossen zangenförmigen, fast gleich dicken Sterigmen, ohne die Sterigmen 45 - 50 × 2,3—3,5 μ (Gipfel bis 5 μ breit). Sterigmen 17—27 μ lang, zugespitzt.

Sporen einzellig, mit protoplasmatischem Inhalt und einigen kleinen Vakuolen, farblos, elliptisch, an der Basis einseitig schief ausgezogen, 7.5 —12,5 × 4—4,5 μ, sofort mit kugelförmigen Konidien auf Stielchen keimend.

Das Subhymenial- und Hutgewebe ist gleichartig aufgebaut, nur sind an der Hutoberfläche die Hyphen dünner und stehen dichter beisammen. Das Gewebe besteht aus ganz steifen, dünnen, wenig verzweigten Hyphen, welche dem Hymenium entspringen, und gebogenen, verzweigten, sich plötzlich blasenförmig erweiternden Hyphen mit an den Querwänden angehäuften, orangen Farbstoffkörnchen. Vielleicht spielen diese Blasen eine Rolle bei der Wasserspeicherung. Die Körnchen färben sich mit Jod schwarzblaugrün, mit Schwefelsäure hell rötlich.

HOLTERMANN macht noch weitere Angaben über die Sporenkeimung. Dabei teilt sich die Spore durch eine Querwand, erst werden reichlich Konidien gebildet, welche sehr verschieden gross sind und schliesslich folgt die eigentliche Keimung mit einem Keimschlauch.

Auf faulendem Holz. Hortus bogoriensis, leg. C VAN OVEREEM.

5. Ueber javanische *Clavariaceae.*

Durch die zytologischen Forschungen von MAIRE (Recherches cytologiques et taxonomiques sur les Basidiomycètes, Bulletin d. l. Soc. Mycolog. d. France XVIII 1902) aber besonders durch die neuesten Untersuchungen von JUEL (Cytologische Pilzstudien I, Nova Acta Regiae Societatis Scientiarum Upsaliensis Ser. IV Vol. 4 no. 6 1916) ist die Forschung der *Clavariaceae* in ein ganz neues Stadium getreten und ist höchst kompliziert geworden. Diese Komplikation ist so gross, dass sie die Systematik der *Clavaria*-Arten von jetzt ab weit über jede Mitarbeit der Dilettanten hinaus hebt, ein Prozess, der sich wohl zu Gunsten der ganzen Basidiomycetensystematik entwickeln wird.

Aus obengenannten Untersuchungen geht folgendes hervor. Die Gattung *Clavaria* im Sinne der alten Umgrenzung ist eine polymorphe Gattung und enthält Arten, welche phylogenetisch nichts mit einander zu tun haben und nur im Habitus mit einander übereinstimmen. Wir sehen in ihr eines der schönsten Beispiele von Konvergenz, denn die Arten stehen an den Enden von Stammbaumästen, welche von ganz verschiedenen Punkten entspringen.

In den Basidien der *Clavarien* liegen bei den Kernteilungen die Spindeln entweder in der Längsrichtung (der stichobasidiale Typus) oder sind quer zur Hauptachse orientiert (der chiastobasidiale Typus). Dieses Merkmal ist das Hauptprinzip der Einteilung. Hieraus würde hervorgehen, dass ohne eine zytologische Untersuchung es nicht möglich wäre, eine *Clavariace* in der richtigen Gattung unterzubringen. Dies ist nicht der Fall, denn mit diesen äusserst schwierig festzustellenden zytologischen Unterschieden sind feine anatomische Merkmale verbunden, welche eine richtige Einteilung sehr gut möglich machen. JUEL hat diese auf folgender Weise schon zusammengefasst:

Stichobasidialer Typus: Basidien zylindrisch, bei der Reife sich stark über das Hymenium verlängerend, aber nicht merklich breiter werdend; Hymenium nicht fixiert sondern in radiärer Richtung weiterwachsend, daher später mit eingestreuten Sporen; Zahl der Sterigmen sehr wechselnd, ursprünglich 8, dann 6, schliesslich 2 (in Verbindung damit stehen ursprünglich drei Kernteilungen; die dritte Teilung ist aber bisweilen unterdrückt).

Chiastobasidialer Typus: Basidien sich bei der Reife nur wenig über das Hymenium emporhebend und oben deutlich angeschwollen, Hymenium fixiert; Zahl der Sterigmen immer vier (in Verbindung damit im Basidium nur zwei Kernteilungen, ausnahmsweise und zufällig noch eine dritte Teilung und diese dann oft in der Spore).

Diese Zusammenstellung ist nicht vollständig, wie ich bald zeigen werde. Betrachten wir jetzt den stichobasidialen Typus etwas näher. Es handelt sich hier um eine Gruppe primitiver Arten, welche zum Teil mit der Gattung *Clavulina* SCHRÖTER zusammenfällt. Diese Gattung ist charakterisiert durch zweisporige Basidien und kugelige, derbwandige Sporen. Davon wurden die Arten, *Clavulina cinerea* und *Cl. cristata* durch JUEL, *Cl. rugosa* und *Cl. grisea* (= *Cl. cinerea*) durch MAIRE untersucht. Alle drei sind ausgesprochen stichobasidiale Typen. Ich möchte schon hier darauf hinweisen, dass die Gattung *Clavulina* in Europa sehr arm an Vertretern ist. Nur fünf Arten gehören zu dieser Gattung.

Ein weiteres wichtiges Merkmal der *Clavulina*- Arten sind die grossen, abstehenden, zangenförmigen Sterigmen. Dies ist von JUEL als stichobasidiales Merkmal ganz übersehen worden. Ich betrachte es aber als sehr wichtig, denn auf diese Weise ist eine Ableitung von oder besser ein gemeinschaftlicher Ursprung mit *Dacryomycetales* nur ein kleiner Schritt. Auch dort haben wir Stichobasidien mit zwei grossen, zangenförmigen Sterigmen. Sie schliessen sich den *Auriculariales* an.

Mit der Gattung *Clavulina* SCHRÖTER ist aber die Zahl der stichobasidialen Typen nicht erschöpft. Zu ihnen gehört auch eine Art, welche unter den Namen *Clavaria falcata* FRIES [1]) durch JUEL untersucht wurde. Die Zahl der Sterigmen schwankt hier zwischen 6 und 8, und die Sporen sind langelliptisch. Es handelt sich hier also um einen abweichenden Typus. Auch andere Arten, welche sich sogar direkt mehr den *Auriculariales* anzuschliessen scheinen, sind hier einzureihen. Ich nenne hier die später zu erwähnende *Clavulinopsis sulcata* V. OVEREEM.

Den *Auriculariales* schliessen sich die *Uredinales* an; ihre Urformen sind wahrscheinlich primitive Hyphenpilze, von welchen auch die *Ustilaginales* abgezweigt sind.

Die meisten *Clavaria*-Arten gehören dem chiastobasidialen Typus an. Diese Gruppe umfasst also die Gattungen *Euclavaria* und *Clavariella* KARSTEN. Die Basidien verlängern sich hier wenig, sind aber bei der Reife am oberen Ende deutlich angeschwollen und tragen meistens 4, aber bisweilen auch 2, aufrechte, pfriemliche Sterigmen. Diese sind hier niemals zangenförmig. Die Sporen sind fast immer zylindrisch oder eiförmig und zeigen oft eine Wandstruktur. Eine dritte Kernteilung im Basidium ist nach der Auffassung von JUEL Ausnahne und Zufall und diese ist oft in die Spore verlegt. Sie wäre nach JUEL für Chiastobasidien nicht charakteristisch und er ist geneigt, ihre zweifache Kernteilung der dreifachen von Sticho-

[1]) Nach COTTON and WAKEFIELD, A revision of the British Clavariae, Transactions of the British Mycological Society VI, Part II 1919 p. 185, ist diese Art wahrscheinlich identisch mit *Cl. acuta* FR.

basidien gegenüberzustellen Dieser Auffassung kann ich nicht beistimmen. Eine dritte Kernteilung in den Chiastobasidien ist meiner Meinung nach für diese gar keine Ausnahme JUEL selbst hat diese für *Clavaria pistillaris* nachgewiesen, während sie bei *Cl. subtilis*, *Cl. fragilis* und *Cl. epichnoa* gänzlich oder auch nur teilweise in die Spore verlegt ist. Es wird sich vielleicht später noch herausstellen, dass drei Kernteilungen für Chiastobasidien sogar charakteristisch sind. Darauf weist das Vorkommen von mehr als vier Sterigmen bei Hymenomyceten mit typischen Chiastobasidien hin.

Die chiastobasidialen *Clavarien* entstammen zweifellos denselben Urformen als die *Tremellales*, ohne direkt aus letztgenannten ihren Ursprung zu nehmen. In dieser Richtung ist eine Brücke mit Ascomyceten, wo die Kernspindel auch quer orientiert sind, zu suchen.

Den Stammbaum der Clavarien können wir also mit Berücksichtigung der Ansichten von MAIRE, VUILLEMIN und JUEL, aufstellen, wie dies auf der nächsten Seite zu sehen ist.

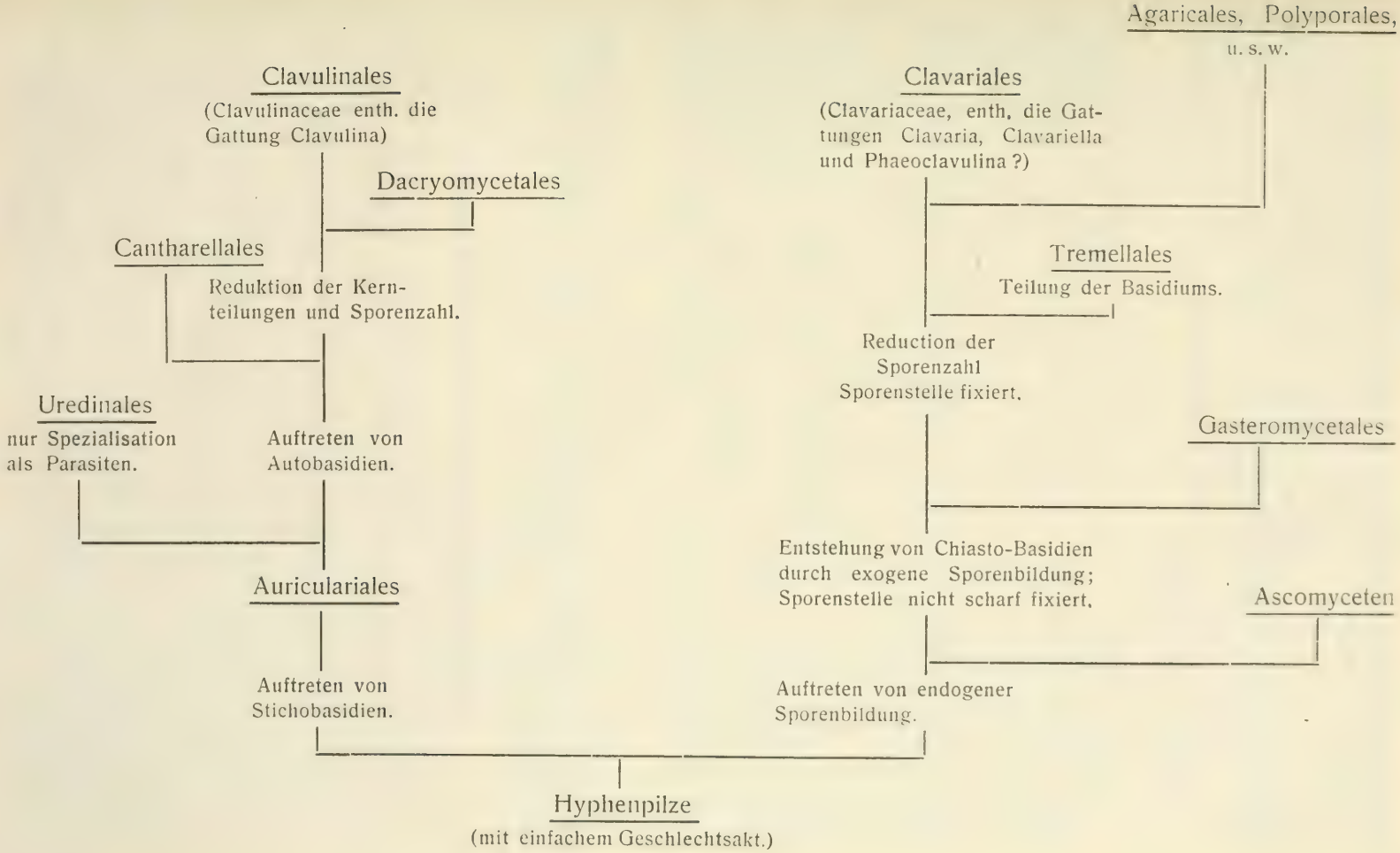
Die Stellung der neu aufgestellten Gattung *Clavulinopsis* ist vorläufig noch sehr zweifelhaft, weil sie noch nicht zytologisch geprüft wurde.

Kehren wir jetzt zu der engeren Systematik der *Clavarien* zurück. Die alte Einteilung ist künstlich, jetzt unbrauchbar und für die Phylogenie wertlos. Eigentlich ist nur *Clavulina* SCHRÖTER aufrecht zu halten (siehe oben); weiter können wir *Clavariella* KARSTEN und *Phaeoclavulina* BRINKMANN aus rein morphologischen Gesichtspunkten beibehalten. Die Untergattungen *Holocoryne* und *Syncoryne* von FRIES und *Ramaria* von HOLMSKJOLD sind wertlos und zu streichen. Nach dieser alten, künstlichen Einteilung sind viele Arten nicht unterzubringen.

Wenn man versucht, tropische Formen mit europäischen Arten zu vergleichen oder zu identifizieren, bemerkt man erst, wie schlecht diese beschrieben sind. Viele Merkmale, welche man für die Charakterisierung ausgewählt hat, sind tatsächlich für diese wertlos. Man hat vergessen, dass man es hier mit primitiven Organismen zu tun hat, welche im Habitus wenig konstant sind. In dieser Beziehung nenne ich z. B. die Art der Verzweigung (dichotom oder mehr unregelmässig), zugespitzte oder stumpfe Endzweige (dies ist gänzlich abhängig von dem mehr oder weniger Auswachsen). Auch einfache Arten können sich unter Umständen verzweigen und büschelig wachsende Arten können auch einzeln vorkommen und umgekehrt. Was die Sporenzahl betrifft, ist sie für *Clavulina* zwei, kann aber auch wechseln von 2 bis 4, wie ich unten zeigen werde; für *Clavaria* und *Clavariella* ist sie meistens 4, bisweilen auch weniger.

Wichtige Merkmale sind die Farbe (die verschiedensten Farben gibt es bei den *Clavarien*), Form der Sterigmen und Basidien, Sporenzahl und Sporenform. Dazu kommt dann Art der Verzweigung (gleichwertige Aeste oder ein Hauptstamm (Strunk), welchem zahlreiche Aeste entspringen) und andere weniger wichtige Merkmale.

In den verschiedenen Merkmalen widersprechen die Bücher manchmal einander vollständig. Die Beschreibungen sind oft kurz, nichtssagend und


Agaricales, Polyporales,
u. s. w.
Clavulinales
(Clavulinaceae enth. die Gattung Clavulina)
Clavariales
(Clavariaceae, enth. die Gattungen Clavaria, Clavariella und Phaeoclavulina ?)
Dacryomycetales
Cantharellales
Tremellales
Teilung der Basidiums.
Reduktion der Kernteilungen und Sporenzahl.
Reduction der Sporenzahl Sporenstelle fixiert.
Uredinales
nur Spezialisation als Parasiten.
Auftreten von Autobasidien.
Gasteromycetales
Entstehung von Chiasto-Basidien durch exogene Sporenbildung; Sporenstelle nicht scharf fixiert.
Ascomyceten
Auriculariales
Auftreten von Stichobasidien.
Auftreten von endogener Sporenbildung.
Hyphenpilze
(mit einfachem Geschlechtsakt.)

manchmal fehlen mikroskopische Angaben. Eine Ausnahme macht die vorzügliche Monographie der Britischen *Clavarien* von COTTON und WAKEFIELD (l.c.). Die Beschreibungen sind dort ausführlich, überall sind genaue mikroskopische Angaben und Bemerkungen über Verwandtschaft, Nomenklatur und Synoniemen hinzugefügt. Ich habe bei der Bestimmung der Javanischen *Clavarien* von dieser Arbeit ausserordentlich viel Nutzen gehabt. Von den übrigen neueren Werken ist besonders das Vademecum von RICKEN unzuverlässig.

Ueber die Geschichte der Javanischen *Clavarien* ist folgendes zu bemerken. JUNGHUHN, der älteste hiesige Pilzforscher, erwähnt nur drei Formen. ZOLLINGER (1842—1844) hat viele Arten gesammelt, welche er zusammen mit MORITZI publizierte; zum Teil wurden diese Arten von LÉVEILLÉ bearbeitet. Den Beschreibungen dieser Arten sind zwar keine mikroskopischen Merkmale hinzugefügt; sie sind mit wenigen Ausnahmen ziemlich genau und ausführlich. Im Jahre 1897—1898 sind von ERIK NYMAN zahlreiche *Clavarien* gesammelt, meistens im botanischen Garten in Buitenzorg. Diese hat HENNINGS in der Monsunia bearbeitet, aber ohne die früheren Arbeiten von ZOLLINGER, LÉVEILLÉ, u. s. w. zu berücksichtigen. Dadurch sind fast sämmtliche Arten zweimal beschrieben. Ich habe mit diesen Beschreibungen von HENNINGS dieselben Erfahrungen gemacht wie VON HÖHNEL bei seinen mikroskopischen Pilzen. Die mikroskopischen Angaben sind ungenau oder öfters falsch und in dieser Hinsicht haben seine unnötigen Neubeschreibungen wenig Wert. VON HÖHNEL hat sich auf Java 1907—1908 weniger mit *Clavarien* beschäftigt. Er erwähnt nur *Clavaria Zippelii.*

Mit einigen Ausnahmen sind untenstehende Arten im botanischen Garten gefunden. Es versteht sich, dass mit dieser kleinen Uebersicht die For schung der Javanischen *Clavarien* nicht erschöpft ist.

Bestimmungsschlüssel der angeführten Arten:

1. Fruchtkörper blutrot, zinnoberrot, einzeln oder büschelig, fast immer unverzweigt, zylindrisch und mehr oder weniger zugespitzt .. .. 2.
   Fruchtkörper gänzlich tief gelb, verzweigt, unverzweigt, einzeln oder büschelig, bisweilen sich etwas bräunlich oder violettlich verfärbend 3.
   Fruchtkörper orange, bleichrötlich, rosa, tief rotbraun oder fleischfarbig, einzeln oder büschelig, verzweigt oder unverzweigt. . . . . 5.
   Fruchtkörper weiss, schmutzigweiss, crêmeweiss, gelblichweiss, verzweigt oder unverzweigt, einzeln oder büschelig. . . . . 8.
   Fruchtkörper hell violettlich oder teilweise mehr oder weniger tief violett, immer verzweigt. . . . . 11.
   Fruchtkörper braun, violettbraun, rötlichbraun, unverzweigt oder verzweigt, einzeln oder büschelig .. . . . . 13.
2. Auf Erde, meistens büschelig, Sporen rundlich, Basidien 2-bis 4-sporig 15. *Clavaria sanguineo-acuta* v. O.

Auf faulenden Blättern und Aestchen, Sporen eiförmig, schief zugespitzt, fast immer einzeln, niemals dichtbüschelig. 13. *Clavaria depokensis* v. O.

3. Fruchtkörper wenig oder unverweigt . . . . . 4.
Fruchtkörper korallenartig verzweigt, mit zahlreichen stark zugespitzten Endästen, Sporen gross und rundlich, Basidien mit 2 Sterigmen. 1. *Clavulina Leveillei* (Sacc.) v. O.

4. Unverzweigt, nicht dicht büschelig, Sporen elliptisch, gelb, Basidien mit gelbem Inhalt . . . . . 11. *Clavaria luteo-tenerrima* v. O.
Unverzweigt oder ausnahmsweise eine kleine Verzweigung, dicht büschelig, Sporen rundlich, gelb . . . 9. *Clavaria fusiformis* Fr.
Unverzweigt, einzeln oder büschelig, hohl und meistens tordiert oder uneben und Form unregelmässig, mehr weisslichgelb oder schön ockergelb, Sporen kugelig . . . . 10. *Clavaria vermicularis* Fr.

5. Fruchtkörper korallenartig verzweig . . . . . 6.
Fruchtkörper unverzweigt oder ein- bis zweimal gegabelt . . . 7.

6. Fruchtkörper fleischig, mit deutlichem Strunk und zahlreichen dichtstehenden parallelen Aesten, rostbräunlich, nur Strunk heller, Sporen elliptisch, stachelig und ockerbraun 17. *Clavariella fragillima* (Henn.) v. O.
Fruchtkörper fleischig, kein deutlicher Strunk, Aeste dichtstehend, unten tief rotbraun, nach oben meistens mehr gelblich, Sporen rund, glatt und farblos . . . . . 3. *Clavulina umbrina* (Lév.) v. O.
Fruchtkörper nicht fleischig, mit deutlichem Strunk, Aeste lose oder dicht stehend, fleischfarbig, Endzweigen schön braunrötlich oder braun, Sporen kugelig, fast farblos. . . 16. *Clavaria alcicornis* Z. et M.

7. Fruchtkörper orange, oft dicht büschelig, unverzweigt . . . . . 8. *Clavaria subaurantiaca* Hennings et Nyman.
Fruchtkörper hell rosa, unverzweigt, einzeln 7. *Clavaria rosacea* Henn.
Fruchtkörper hell rötlich, oft unregelmässig verwachsen, dadurch bandförmig, gekrümmt und verbogen, Sterigmen 1 bis 4, oft sehr verschieden lang. . . . . 19. *Clavulinopsis sulcata* v. Overeem
Fruchtkörper rotbräunlich bis gelblich, dichotom verzweigt . . . . 3. *Clavulina umbrina* (Lév.) v. O.

8. Fruchtkörper unverzweigt, Sporen elliptisch . . . . . 9.
Fruchtkörper oft etwas verzweigt (aber nie korallenartig), oder unverzweigt, Sporen kugelig. . . . . 10.
Fruchtkörper stark lose korallenartig verzweigt (also mit Hauptstrunk), Sporen elliptisch, rauh . . . . . 14. *Clavaria implexa* Lév.

9. Fruchtkörper schmutzig weiss, etwas uneben, tordiert oder verbogen, Gipfel sich bräunend . . . . . 5. *Clavaria fumosa* Fr.
Glänzend reinweiss, glatt, zierlich umgebogen, oft sehr klein (etwa 1 cm lang), Gipfel etwas gelblich. . . 4. *Clavaria vermiculata* Micheli.

10. Fruchtkörper aufrecht, meist büschelig, glatt und dünn, crêmeweiss 6. *Clavaria filiformis* Henn. et Nym.
Fruchtkörper einzeln oder büschelig, dick keulenförmig oder bandförmig und tordiert, unregelmässig, oft oben gespalten, schmutzig weiss, gelblichweiss oder intensiv ockergelb 10. *Clavaria vermicularis* Fr.

11. Sporen kugelig. . . . . 2. *Clavulina fusco-lilacina* (Berk.) v. O.
Sporen elliptisch 12
12 Korallenartig verzweigt (mit deutlichem Strunk) mit sehr zahlreichen aufstrebenden Aesten, Sporen rauh. . . 14. *Clavaria implexa* Lév.
Nicht korallenartig, aber wiederholt gegabelt, ganz hell violett oder oben schön tief violett, Sporen glatt . . . 12. *Clavaria Zollingeri* Lév.
13. Wenig oder unverzweigt, Sporen kugelig, farblos. . . . . 14.
Korallenartig verzweigt, Sporen elliptisch, braun, stachelig . . . 15.
14. Violettbraun oder schmutzigbraun, Basidien 2-sporig. . . . . 2. *Clavulina fusco-lilacina* (Berk.) v. O.
Schön rotbraun, oben oft gelblich, Basidien 2-bis 4-sporig. . . . . 3. *Clavulina umbrina* (Lév.) v. O.
15. Fruchtkörper rötlichbraun bis schmutzigbraun, bisweilen Zweigende prachtvoll tief blau oder grünblau, Basidien 2-sporig, Sporenstaub zimtbraun. . . . . 18. *Phaeoclavulina Zippelii* (Lév.) v. O.
Fruchtkörper gelblichbraun bis rostbraun, Basidien 4-sporig, Sporenstaub frisch rostbraun . . . . 17. *Clavariella fragillima* (Henn.) v. O.

CLAVULINA SCHRÖTER.

1. Clavulina Leveillei (SACCARDO) V. OVEREEM nov. comb.

Synoniemen:

Clavaria alcicornis. LÉV. non ZOLLIGER et MORITZI (Ann. d. Sciences Nat., Bot., Sér. 3 Vol. V 1846 p. 155).

Clavaria Leveillei SACCARDO (Sylloge Fungorum VI 1888 p. 709).

Clavaria corniculata ZOLLINGER et MORITZI non SCHÄFFER (Natuur-en geneeskundig Archief voor Neêrland 's-Indië I 1844 p. 382; A. MORITZI, System. Verzeichnis der von H. ZOLLINGER in den Jahren 1842—1844 auf Java gesammelten Pflanzen, Solothurn 1845—1846 p. 124; H. ZOLLINGER, System. Verzeichnis der im indischen Archipel in den Jahren 1842—1848 gesamm. Pflanzen, Zürich 1854 p. 12.)

Clavaria cristatula HENN. et NYMAN (Monsunia I 1900 p. 8).

Abbildung:
Icones fungorum malayensium Heft 2 Tafel II Fig. 1, a-c.

Fruchtkörper 2,5—7 cm hoch, korallenartig verzweigt, entweder unansehnlich, zart und fein oder gross und ziemlich fleischig, schön schwefelgelb, im Alter bisweilen violettbräunlich oder rotbraun. Strunk sehr verschieden, bei sehr kleinen Exemplaren fehlend, kurz und dick oder bis 2 cm lang, sich auflösend in zwei bis mehr fast gleich dicke Aeste. Aeste schwach divergierend und aufrecht, manchmal etwas gebogen, 2 bis 3 mal gegabelt und dabei immer dünner werdend, bei vollständigem Auswachsen sich auflösend in 2 bis 3 (selten mehr) scharf zugespitzte, oft weit abstehende Endzweige. Hyphen des inneren Gewebes mit gelbem Inhalt.

Basidien immer 2-sporig, farblos, sehr verschieden lang, oben fast nicht angeschwollen, 27—46 x 5,5 μ, mit 2 grossen bis 10 μ langen zangenförmig abstehenden Sterigmen.

Sporen kugelig, gross, farblos, Anheftungsstelle stumpf ausgezogen, mit einem grossen, zentralen, stark lichtbrechenden Öltropfen und bisweilen einigen kleinen Körnchen, 6,5—9 μ i. D.

Subhymeniale Hyphen mit schwefelgelbem Inhalt.

Auf Erde, Tjibodas, G. Gede, West Java, ± 1400 m (leg. W. DOCTERS VAN LEEUWEN; C. ET D. VAN OVEREEM-DE HAAS).

Die Art ist keine seltene Erscheinung. Sie wurde wiederholt in Tjibodas gesammelt, während NYMAN sie im hiesigen botanischen Garten gefunden hat.

LÉVEILLÉ hat zuerst diese Art unter *Clavaria alcicornis* ZOLL. et MOR. angeführt. Er vergleicht sie mit *Clavaria cristata* FRIES, womit sie tatsächlich verwandt ist. Auch erwähnt er ausdrücklich die gelbe Farbe. Nur beschreibt er die Endzweige als stumpf, was aber gelegentlich auch bei unserer Art vorkommt. Mit *Cl. alcicornis* ZOLL. et MOR. hat sie aber nichts zu tun, daher hat SACCARDO ihren Namen geändert.

Clavulina Leveillei ist morphologisch kaum von *Clavaria corniculata* FRIES zu trennen. Die gelbe Farbe, die Art der Verzweigung, u.s.w. haben beide Arten gemein. Zwar geben COTTON and WAKEFIELD (l. c. p. 181) in ihrer Monographie an, dass die Endzweige von *Cl. corniculata* nicht scharf zugespitzt sind, aber dies steht nicht im Einklang mit ihrer Angabe, dass *Clavaria muscoides* L., von welcher Art überall angegeben wird, dass die Endzweige scharf zugespitzt sind, mit ersterer identisch ist. Wie ich schon früher betonte, ist auf dieses Merkmal kein Wert zu legen. Weiter sind auch die Sporen und Sporenmassen dieselben. Der einzige Unterschied besteht nur in Zahl und Form der Sterigmen. Bei *Cl. corniculata* gibt es 4 aufrechte Sterigmen. Ich habe unsere Art wiederholt untersucht, aber immer 2 zangenförmige Sterigmen gefunden. *Clavaria corniculata* SCHÄFFER wird von ZOLLINGER selbst erwähnt (siehe oben). Er hat sie auf Erde bei Tjikoja gefunden (ZOLLINGER, Herb. normale 1121) und beschreibt die Endzweige als "lunulatis acutis". Zweifellos handelt es sich hier um unsere *Clavulina Leveillei*. Was HENNINGS später als *Clavaria cristatula* beschrieb, sind nur kleine Exemplare unserer Art. Er erwähnt auch die zangenförmigen Sterigmen. Seine Angabe über ihre Anzahl (4) ist unrichtig. Das übrige stimmt.

Es wäre möglich, dass auch die *Clavaria coronata* ZIPPEL (= *Cl. turgida* LÉV.) identisch ist. Die Beschreibung stimmt ziemlich gut, nur das Substrat („ad truncos") ist verschieden. Also habe ich nicht auf eine Identifizierung schliessen zu dürfen.

Unsere Art ist schon von KUHL und VAN HASSELT [1]) trefflich abgebildet worden. Noch möchte ich erwähnen, dass JUEL *Clavaria muscoides* L. zytologisch prüfte. Sie hat Chiastobasidien mit 4 aufrechten Sterigmen. Also scheint mir eine Identifizierung mit *Clavulina Leveillei* ausgeschlossen.

[1]) In der Bibliothek in Buitenzorg gibt es eine Sammlung farbiger Abbildungen von KUHL und VAN HASSELT. Darunter sind viele Pilze, welche nur zum Teil von den Autoren benannt wurden. Publiziert wurden sie nie.

2. **Clavulina fusco-lilacina** (BERK.) v. OVEREEM nov. comb.

Synoniemen:
Clavaria fusco-lilacina BERKELY (HOOKER's Journ. of Botany, Vol. VIII 1856 p. 276).

Abbildung:
Icones fungorum malayensium Heft 2 Tafel II Fig. 4, a—d.

Fruchtkörper 3—7 cm hoch, 2—8 mm dick, im Habitus ausserordentlich verschieden: entweder einfach kurz keulenförmig, starr, in einen kurzen Stiel verschmälert, oder verlängert keulenförmig, verbogen und etwas um einander geschlängelt und lang gestielt, oder ein bis zweimal verzweigt und Zweige oft dicht zusammengedrängt. Gipfel wenig verschmälert und abgerundet, bisweilen kopfförmig angeschwollen, etwas breit gedrückt und gefaltet oder stark zugespitzt. Die Keulen stehen einzeln, in kleinen Gruppen oder dicht rasig. Farbe meistens violettlichbraun, bisweilen schön dunkel braunviolett, von den Sporen weisslich bereift, im Alter stark verbleichend zu braungrau oder ockergrau. Stiel immer schön ockerbraun, wenig oder stark ausgebildet, allmählich in die Keule übergehend, 3 bis 25 mm lang, 1 bis 2 mm breit.

Basidien immer mit 2 ziemlich kleinen aber zangenförmig abstehenden Sterigmen, oben nicht angeschwollen, schlauchförmig, $46-52 \times 5{,}7-7\ \mu$.

Sporen kugelig, gross, farblos, mit einem grossen Öltropfen, derbwandig, spitz ausgezogen, $7-8\ \mu$ i. D.

Auf Erde, Hortus bogoriensis, (leg. C. et D. VAN OVEREEM-DE HAAS; ibid. leg. W. DOCTERS VAN LEEUWEN).

BERKELY hat in seinen Decades of Fungi, Dec. LXI—LXII, Hooker's Journ. of Botany, Vol. VIII 1856 p. 276 obenstehende Art nur kurz beschrieben, ohne mikroskopische Angaben. Diese Beschreibung stimmt aber so genau, dass zweifellos dieselbe Art vorliegt. Sie wurde zuerst von SPRUCE in Brasilien gefunden.

Die Art ist mit *Clavaria purpurea* FRIES und *Cl. incarnata* WEINM. leicht zu verwechseln. Die Sporen sind bei diesen Arten jedoch oval und die Basidien kürzer; auch die Farbe weicht ab.

Bisweilen findet man an den Endzweigen schwarzbraune, scharf zugespitzte Gebilde. Meiner Meinung nach handelt es sich hier um Hemmungsbildungen durch Witterungsverhältnisse.

3. **Clavulina umbrina** (LÉV.) v. OVEREEM nov. comb.

Synoniemen:
Clavaria umbrina LÉVEILLÉ (Annales d. Sciences nat., 3 Série Vol V 1846 p. 155 no. 194).
Clavaria furcata HENNINGS et NYMAN (Monsunia) I 1900 p. 9).

Abbildung:
Icones fungorum malayensium Heft 2 Tafel II Fig. 2, a—d.

Fruchtkörper bis 7 cm hoch, ein bis dreimal gegabelt, Verzweigung bisweilen unregelmässig, einzeln oder büschelig und dicht zusammengedrängt. Äste zuerst wenig divergierend, dann aufrecht, dick, starr, selten gebogen und dünn, allmählich in den nicht abgegrenzten Stiel übergehend, oben sich in zwei kurze, spitze oder zwei längere, halbmondförmige, stumpfe Endzweige auflösend, oder abgerundet ohne Endzweige; schön purpurfarbig oder purpurbraun, bei den Endzweigen allmählich in goldgelb übergehend, bisweilen aber ganz gelblich; Aeste 1—4 mm breit, bei den Verzweigungen mehr oder weniger aufgeblasen und breitgedrückt.

Basidien mit 2 oder 4 Sterigmen, lang gestielt, mit zahlreichen Öltropfen oder körnigem, gelbem Inhalt, 46—58 × 5,7—8,5 μ.

Sterigmen gross, etwas zangenförmig abstehend, 10—14 μ lang.

Sporen kugelig, derbwandig, mit einem grossen, selten mit zwei Öltropfen, gleichmässig stumpf ausgezogen, erst goldgelb, später farblos, 5—7 (-9) μ i. D.

Auf Erde, Hortus Bogoriensis, wiederholt gefunden.

Die Unterbringung in die Gattung *Clavulina* ist noch etwas zweifelhaft und die zytologische Untersuchung wird dies aufklären. Die Basidien sind nicht schlauchförmig, sondern unten deutlich stielförmig verschmälert und die Sterigmenzahl beträgt meistens 4. Die Sterigmen sind aber deutlich gekrümmt und abgebogen, sehr gross und die Sporen sind kugelig und derbwandig, Merkmale, welche zweifellos auf die Gattung *Clavulina* hinweisen.

Die Art wurde zuerst von ZOLLINGER auf Erde bei Tjikoja auf Java gefunden und von LÉVEILLÉ beschrieben. Die Diagnose ist ziemlich kurz und unvollständig. Seine Angaben sind aber charakteristisch genug, um eine Identifizierung zuzulassen: „ramis confertis, fuscis, apice dilatatis cristatis acutis". *Clavaria furcata* HENNINGS et NYMAN ist zweifellos dieselbe Art. Die Beschreibung bezieht sich auf kleine, gedrungene Exemplare, ist aber unvollständig. Sie wurden von NYMAN im hiesigen botanischen Garten auf Erde gesammelt.

MORITZI (System. Verzeichn. 1845—1846 p. 124) und ZOLLINGER (System. Verzeichn. 1854 p. 12) erwähnen sie unter der Nummer 2077 (Herb. normale).

CLAVARIA VAILLANT,

4. Clavaria vermiculata MICHELI,

(Nova plantarum genera, 1729 p. 209 Taf. 87 Fig. 12)

Abbildung:
Icones fungorum malayensium Heft 2 Tafel IV Figur 3, a—b.

Fruchtkörper zylindrisch oder pfriemlich, nie verzweigt, einzeln und zerstreut oder schwach büschelig, normal bis 10 cm lang, 1—3 mm breit, bisweilen aber klein, kaum 10 mm hoch und 1 mm breit, unten und oben verschmälert,

reinweiss, fast etwas glasig, Gipfel später etwas gelblich, sehr gebrechlich, aufrecht aber meistens zierlich gekrümmt oder wurmförmig verbogen.

Basidien mit 4 dünnen, pfriemlichen, aufrechten Sterigmen, oben wenig angeschwollen, mit körnig plasmatischem Inhalt, $40 \times 4{,}5—5{,}7\ \mu$.

Sporen eiförmig-zylindrisch, unten zugespitzt, mit feinkörnigem Inhalt, farblos $5—5{,}7 \times 2{,}3—3\ \mu$.

Auf Erde, Tjibodas, G. Gede, W. Java, ± 1400 m, (leg C. et D. VAN OVEREEM-DE HAAS); Buitenzorg, Bambusawald, (leg. C. R. BAKHUIZEN V. D. BRINK Jun.).

Die Art hat keinen typischen Geruch oder Geschmack.

Sie kommt in Tjibodas ziemlich häufig vor.

In den meisten Büchern und Abhandlungen wird sie nicht angeführt. Nur WINTER (Rabenh. Kryptog. Fl. 1e Abteilung Bd. I p. 307) und RICKEN (Vademecum für Pilzfreunde 1918 p. 257) erwähnen sie. Die reinweisse Farbe, grosse Gebrechlichkeit und der Habitus stimmen vorzüglich. RICKEN beschreibt die Sporen als zylindrisch, glatt und farblos. Ich fand die Sporen etwas grösser und etwas eiförmig.

5. **Clavaria fumosa** FRIES,

(System. Myc. I p. 483)

Synoniemen:

Clavaria fumosa PERS. (Obs. Myc. I p. 31).

Abbildung:

Icones fungorum malayensium Heft 3 Tafel III Fig. 6, a-b.

Fruchtkörper unverzweigt, mehr oder weniger dicht büschelig, bisweilen aber einzeln, bis 7,5 cm hoch, 1,5—3 mm dick, zylindrisch oder etwas keulig, oben stumpf oder allmählich zugespitzt, unten stielförmig verschmälert, grauweiss, später, besonders die Gipfel sich bräunend, zuletzt ganz rauchfarbig, öfters gebogen, verdreht, oder etwas abgeplattet, glatt, aber manchmal der Länge nach gefurcht.

Fleisch weiss, riecht etwas knoblauchartig.

Basidien mit 4 Sterigmen, oben deutlich angeschwollen, $30—40 \times 5{,}5—7\ \mu$.

Sterigmen aufrecht, kurz und spitz.

Sporen hyalin, glatt, zylindrisch-eiförmig, unten kurz und schief zugespitzt, mit körnigem Inhalt, $5{,}7—7{,}5 \times 2{,}8—4\ \mu$.

Das innere Gewebe besteht aus kurzzylindrischen, regelmässig geordneten Zellen, $28—57 \times 10—14\ \mu$.

Auf humöser Erde, wiederholt von mir in Buitenzorg gesammelt.

Eine häufige Art; einmal wuchs sie zu tausenden zwischen Gras und Steinen längs einer Hauptstrasse. Auch im botanischen Garten ist sie gefunden worden.

Meine Exemplare stimmen trefflich mit der Beschreibung von COTTON und WAKEFIELD (l. c. p. 183—184). Die Art ist gut charakterisiert durch die schmutzigweisse Farbe, die braunen Gipfel, die innere Zellstrucktur und die kurzen Sterigmen. *Cl. vermiculata* MICHELI ist durch ihre reinweisse Farbe und kleinere Sporen gut unterschieden.

6. Clavaria filiformis HENNINGS et NYMAN,

(Monsunia I 1900 p. 8)

Abbildung:
Icones fungorum malayensium Heft 3 Tafel III Fig. 7, a-b.

Fruchtkörper nicht verzweigt, bisweilen mit der Basis zusammenhängend, einzeln und zerstreut oder dicht büschelig, zylindrisch, aufrecht und starr oder etwas hin und her gebogen, unten nicht und oben fast nicht verschmälert und stumpf, elfenbeinweiss oder crêmeweiss, Basis mehr gelblich bis tiefgelb, glatt und glänzend, 3—8,5 cm hoch, 1—1,5 mm breit, bisweilen aber sehr klein, kaum 1 cm hoch und dann oft zerstreut.

Basidien mit 2 oder 4 Sterigmen, oben stark angeschwollen, mit zahlreichen Öltropfen, 40 (—50) × 7—8,5 μ.

Sterigmen gross, besonders gegenüber den kleinen Sporen, erst blasig, dann mehr spitz, aufrecht, 2 oder 4, nur bei geschrumpften Basidien mehr abstehend, etwa 6 μ lang.

Sporen kugelig, klein (3,5)—4,5—5 μ i. D., mit grossem Öltropfen, glatt und farblos, mit sehr kurz ausgezogenem Spitzchen.

Auf Erde, Naturschutzgebiet „Depok", Res. Batavia, (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM-DE HAAS) und botanischer Garten zu Buitenzorg (leg. C. VAN OVEREEM).

Eine ziemlich variable Art, aber durch die starren, aufrechten Fruchtkörper, ihre Farbe und besonders durch die kleinen kugeligen Sporen von den übrigen weissen Arten gut verschieden. Sie ist verwandt mit *Cl. acuta* FRIES, aber die Sporen sind bei unserer Art fast um die Hälfte kleiner.

Die Habitusbeschreibung bei HENNINGS stimmt ziemlich gut, seine mikroskopischen Angaben aber sind falsch. Die Basidien sind viel grösser und die Sporen sind farblos, nicht gelb. Mit *Cl. fusiformis* SOW. hat unsere Art die kugeligen Sporen und die grossen Sterigmen gemein.

7. Clavaria rosacea HENNINGS,

(VOELZKOW, Reise in Ostafrika III 1908 p. 19 Taf. II Fig. 5)

Abbildung:
Icones fungorum malayensium Heft 3 Tafel III Fig. 3,a.

Fruchtkörper unverzweigt, 3,5—14 cm hoch, 1—4 mm breit, zylindrisch oder mehr breit gedrückt, aufrecht und schwach gekrümmt oder wellenförmig gebogen, bisweilen furchig oder etwas gewunden, oben deutlich zugespitzt und Spitze oft umgebogen, unten wenig verschmälert, schön rosa, bei der Sporenreife mehr weisslich rosa, Basis etwas gelbbräunlich.

Basidien mit 4 Sterigmen, oben schwach angeschwollen, mit plasmatischem Inhalt, 32—36 × 5,5—7 μ.

Sterigmen zugespitzt, aufrecht, etwa 6 μ lang.

Sporen kugelig, farblos, glatt, mit einem zentralen Öltropfen, allmählich schwach ausgezogen, 4—5, 5 μ i. D.

Auf Erde, Naturschutzgebiet „Depok", Res. Batavia (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM- DE HAAS).

Die Beschreibung von HENNINGS stimmt in jeder Hinsicht trefflich, nur das Substrat (Baumrinde) stimmt nicht. Das Material wurde auf Madagascar gesammelt. HENNINGS vergleicht sie mit *Cl. laeta* BERK. et BROOME und *Cl. Braunii* HENNINGS. Mit *Cl. laeta* (auf Erde auf Ceylon gefunden) ist sie jedenfalls verwandt; nur sind dort die Sporen grösser (8 μ) und von der Farbe sagen die Autoren „nitide rubra". Mit *Cl. Braunii*, einer kleiner goldgelben Art mit ganz anderen Sporen hat sie nichts zu tun.

Im Habitus ist sie der *Clavaria rosea* FR. sehr ähnlich, und die Beschreibung bei COTTON und WAKEFIELD (l. c. p. 188) stimmt vorzüglich, nur die Sporenform ist verschieden: ovoid oder breit elliptisch, $7-10 \times 5-6\ \mu$. Nach SACCARDO, Sylloge VI p. 717 sind sie aber 2 μ i. D., während RICKEN angibt $6-7 \times 5\ \mu$ und punktiert. Diese Art ist also ziemlich unsicher.

8. **Clavaria subaurantiaca** HENNINGS et NYMAN, (Monsunia I 1900 p. 8)

Synoniemen:

Clavaria persimilis COTTON (Transactions of the British Mycological Society, III 1909 p. 182).

Abbildung:

Icones fungorum malayensium Heft 3 Tafel III Fig. 1, a-c,

Fruchtkörper dicht büschelig, bisweilen aber zu zweien oder einzeln, unverzweigt, ausnahmsweise verzweigt und dann der Länge nach gefurcht, stielrund, oder etwas breitgedrückt, nach unten mehr oder oder weniger, nach oben immer deutlich und gleichmässig verschmälert und zugespitzt, aber nicht scharf; meistens etwas buchtig, sogar wurmförmig, 3,5—9,5 cm hoch, 1,5—3 mm breit, leuchtend gelblichorange oder orange, im trockenen Zustand dunkel orange, von den reifen Sporen weisslich bereift.

Subhymeniale Hyphen mit zahlreichen kleinen, eckigen, orangefarbigen Körnchen.

Basidien mit 4 Sterigmen, keulenförmig, $35-40 \times 6-7{,}5\ \mu$, farblos.

Sterigmen ziemlich gross, aufrecht, etwa 6—8 μ lang.

Sporen kugelig, farblos, mit einem zentralen, grossen Öltropfen, allmählich stumpf ausgezogen, 3,5—5 μ i. D. oder 5,7—6,3 μ lang.

Auf Erde, Hortus bogoriensis (leg. W. DOCTERS VAN LEEUWEN et C. VAN OVEREEM); Tjibodas, G. Gede, W. Java, 1400 m (leg. C. et D. VAN OVEREEM -DE HAAS).

Die Art ist im hiesigen botanischen Garten eine häufige Erscheinung. Sie riecht etwas nach Knoblauch.

Die kleinen, orangefarbigen Körperchen in den subhymenialen Hyphen färben sich mit Jod grün; mit Schwefelsäure geben sie keine Reaktion, also handelt es sich hier nicht um ein Karotinoid.

NYMAN hat die Art zuerst im hiesigen botanischen Garten gefunden. Die Beschreibung stimmt gut, nur haben kleine Exemplare vorgelegen. Die Basidien hat HENNINGS etwas länger gefunden (bis 50 μ) und die Sporen etwas grösser (6—8 μ).

Clavaria persimilis COTTON ist zweifellos identisch. Die Beschreibung stimmt trefflich, nur sind die Sporen etwas weniger rundlich angegeben.

9. **Clavaria fusiformis** FRIES,
(System. Mycol. I p. 480)

Synoniemen:

Clavaria fusiformis SOWERBY (Coloured Figures of English Fungi or Mushrooms, Tab. 234).

Clavaria fasciculata PERSOON (Commentatio de fungis clavaeformibus, 1797 p. 72).

Clavaria ceranoides PERSOON (Synopsis methodica fungorum, 1801 p. 594).

Clavaria amoena ZOLLINGER et MORITZI (Natuur- en Geneeskundig Archief voor Neêrlands-Indië, I 1844 p. 380—381).

Abbildung:

Icones fungorum malayensium Heft 3 Tafel III Fig. 2, a—b.

Fruchtkörper fast immer dicht büschelig oder sogar rasig, selten wenige zusammen, unverzweigt, selten gegabelt und dann oft etwas unregelmässig und breitgedrückt, 2,5—7 cm hoch, 1—3,5 mm breit, spindelförmig, gebogen und um einander geschlängelt, bisweilen verdreht, nach oben allmählich zugespitzt, nach unten in einen ziemlich langen, dünnen, oft gewundenen Stiel verschmälert oder Stiel fast gar nicht ausgebildet, hochgelb, bisweilen etwas orangegelb, innen hohl. Geschmack bitter.

Basidien mit 4 Sterigmen, keulenförmig, mit körnigem, plasmatischen Inhalt, welcher sich schliesslich gelb färbt, ziemlich verschieden lang, 40—50 $\times$ 6—8,5 μ. Sterigmen breit und zugespitzt, fast aufrecht, etwa 5,5 μ lang.

Sporen rein kugelig, mit aufgesetztem, stumpfen bisweilen weit hervorragenden Anheftungsstielchen, zuerst farblos und mit einem zentralen Öltropfen, schliesslich intensiv grünlichgelb, 4—6 μ i. D.

Auf Erde, Hortus bogoriensis (leg. C. VAN OVEREEM); Tjibodas G. Gede, W. Java, 1400 m (leg. B. SCHWARZ).

Das Material stimmt trefflich mit der ausführlichen Beschreibung von COTTON et WAKEFIELD (l. c. p. 184).

Die Art wurde zuerst von Prof. Dr. E. HEINRICHER auf Java gesammelt und von BRESADOLA bestimmt als *Cl. fusiformis* SOW. (Fungi Javanici lecti a. cl. Prof. Dr. E. HEINRICHER; Annal. Mycol., V 1907 p. 240).

Clavaria amoena ZOLL. et MOR. ist wohl identisch. Die Beschreibung bezieht sich auf kleine, ärmliche Exemplare. Zwar sagen die Autoren von ihren Exemplaren „pulcherrime aurea", es käme dafür also auch die *Clavaria*

subaurantiaca HENN. et Nym. in Betracht. Allein sie beschreiben die Fruchtkörper als hohl und innen mit Fadenstruktur, Merkmale, welche nur bei *Cl. fusiformis* FR. vorkommen. Auch ihr Vergleich mit *Cl. spiralis* JUNGH. spricht für diese Auffassung. COTTON und WAKEFIELD geben an, dass die Sporen zuerst gelb sind und später farblos werden. Ich glaube, dass die Sache sich gerade umgekehrt verhält. Darauf deutet schon hin, dass der Inhalt der Basidien sich auch später gelb färbt.

Die Sporenbeschreibung bei RICKEN (l. c. p. 256—257) ist falsch.

Die Gipfel von Exemplaren, welche ich im botanischen Garten sammelte, waren bisweilen leuchtend weinrot gefärbt. Wahrscheinlich handelt es sich hier um einen Fäulnisprozess, durch Bakterien verursacht.

10. Clavaria vermicularis FRIES,

(System. Mycol. I p. 4)

Synoniemen:

Clavaria striata PERSOON (Icones et descriptiones fungorum minus cognitorum, 1798—1800 p. 11 Taf. III Fig. 5.

Clavaria fragilis HOLMSKJOLD (Beata ruris stia Fungis Danicis impensa, 1790 p. 7).

Clavaria vermiculata SCOPOLI (Flora Carciolica, Editio secunda, II 1772 p. 483.

Clavaria spiralis JUNGHUHN (Verhandelingen v.h. Bataviasche Genootschap, XVII 1839 p. 32 Fig. 19) (?)

Abbildung:

Icones fungorum malayensium Heft 4 Tafel IV Fig. 1, a-c.

Fruchtkörper entweder einzeln oder dicht büschelig, 2,5 – 8 cm hoch, 1—15 mm breit unverzweigt oder ausnahmsweise etwas verzweigt, im Habitus ausserordentlich verschieden: die büschelig stehenden Exemplare meistens spindelförmig und breitgedrückt, sogar bandförmig, nach oben verschmälert und abgerundet, nie scharf zugespitzt; die einzeln stehenden Exemplare keulenförmig und oben stumpf abgerundet; nach unten fast immer stielförmig verschmälert, etwas buchtig, wurmförmig und öfters gewunden; Oberfläche glatt oder runzelig uneben, der Länge nach gefurcht; schmutzigweiss, crêmeweiss oder hell ockergelblichweiss, bisweilen tief ockergelb; immer hohl, schliesslich oben gespalten, bisweilen becherförmig oder bis zum Boden gespalten und auseinander weichend; innen gelblichweiss; sehr gebrechlich.

Basidien mit 4 Sterigmen, keulenförmig, farblos, 45—50 × 7—9 μ.

Sterigmen gross, aufrecht, bis 10 μ lang.

Sporen fast kugelig, stark lichtbrechend, 4 – 6 × 5,5 – 8 μ, mit allmählich stumpf ausgezogener Anheftungsstelle, glatt, farblos.

Auf Erde, Hortus bogoriensis, wiederholt gefunden; Tjibodas, G. Gede, W. Java, 1400 m (leg. P. DAKKUS).

Die Beschreibung bei COTTON und WAKEFIELD stimmt ziemlich gut, nur ist die Variabilität der verschiedenen Merkmale bei unseren Exemplaren

viel grösser. Die Sporen geben sie jedenfalls viel zu klein an (3—5 × 3—4 μ). Nach LINDAU (Kryptogamenflora für Anfänger, I (zweite Auflage) 1917 p. 32) sind die Sporen 6—8 × 3—5 μ, was gut stimmt. Auch die Beschreibung bei RICKEN (l. c. p. 257 sub *Cl. fragilis* HOLMSKJ.) stimmt gut, wie die Abbildung und Beschreibung bei MICHAEL (Führer für Pilzfreunde, B, II 1918 No. 110).

Clavaria spiralis JUNGHUHN ist nach der Abbildung vielleicht nichts anders als stark gespaltene und tordierte Exemplare unserer Art.

Dasselbe gilt fur *Cl. striata* PERS., von welcher die Abbildung in JUILLARD-HARTMANN, Iconographie Vol. V, reproduziert wurde.

Gewundene Exemplare unserer Art stimmen im Habitus mit *Cl. contorta* FR. überein, aber diese Art hat grosse elliptische Sporen und wächst auf toten Ästchen. Es wäre möglich, dass auch *Cl. strigosa* HENNINGS et NYMAN (Monsunia I 1900 p. 8) mit unserer Art identisch ist. Die Beschreibung stimmt bis auf die striegelhaarige Basis vollständig. Sie wurde auch im hiesigen botanischen Garten auf Erde von NYMAN gesammelt.

11. **Clavaria luteo-tenerrima** V. OVEREEM nov. spec.

Abbildung:
Icones fungorum malayensium Heft 3 Tafel III Fig. 5, a-b.

Fruchtkörper unverzweigt, einzeln oder zu wenigen beisammen, 1—5,5 cm hoch, 0,5—2 mm dick, zart und fein, keulenförmig und oben stumpf oder fast fadendünn und zugespitzt, auch etwas breitgedrückt und gewunden, aufrecht oder gekrümmt, intensiv goldgelb, später schmutziggrünlichgelb.

Basidien mit 4 Sterigmen, kurz keulenförmig, öfters buchtig, mit tief gelbem, körnigen Inhalt, welcher später bronzefarbig wird, 25—30 × 5—6,5 μ.

Sterigmen aufrecht, kurz und spitz, etwa 5 μ lang.

Sporen zylindrisch oder eiförmig-zylindrisch, unten kegelig zugespitzt, glatt, mit farbloser Membran, tief grünlichgelbem, homogenen Inhalt und öfters mit einem zentralen, farblosen Öltropfen. 5,5—8,5 × 3,2—4 μ.

Das innere Gewebe besteht aus kurz zylindrischen, etwa 6,5 μ breiten, farblosen Zellen und dazwischen dünnen, verzweigten farblosen Hyphen mit deutlichen Schnallen und lichtbrechendem Inhalt.

Auf Erde, Naturschutzgebiet "Depok" zwischen Batavia und Buitenzorg, (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM-DE HAAS).

Eine winzige Art, gut charakterisiert durch die gelben Sporen und Basidien. Sie ist der *Cl. luteo-ochracea* CAV. sehr ähnlich. Der Stiel dieser Art ist aber rotbraun-ockergelb und von einem gelben Inhalt von Sporen und Basidien wird nichts angegeben. *Cl. biformis* ATKINS. hat kleinere und farblose Sporen. Auch steht sie in der Nähe von *Cl. inaequalis* FRIES. Die Habitusbeschreibung dieser Art stimmt gut, so auch die gelben Basidien (siehe COTTON und WAKEFIELD, l. c. p. 189). Die Sporenbeschreibung (fast kugelig, ockerfarbig und rauh) weicht aber gänzlich ab. Nach SCHRÖTER sind die Sporen 5—7 × 4 μ, was mit unserer Art übereinstimmt. Nun wurde

von ZOLLINGER bei Tjikoja (W. Java) auf Erde eine Clavariace gefunden, welche von LÉVEILLÉ mit *Cl. helvola* Pers. (= *Cl. inaequalis* FR.) identifiziert wurde (ZOLLINGER, Verzeichnis, 1854 p. 12 (Herb. proprium Zollingeri 104). Wahrscheinlich handelt es sich hier um unserer Art. Was die meisten europäischen Autoren unter *Cl. inaequalis* verstehen, bleibt vorläufig unsicher.

Clavaria luteo-tenerrima v. OVEREEM nov. spec.

Simplex, solitaria vel pauca congregata, 1—5,5 cm alta, 0,5—2 mm crassa, tenerrima, nunc clavata et apice obtusa, nunc filiformis et acuminata, nunc late compressa et torta, erecta vel curvata, lutea, postremo sordide viride-lutea.

Basidiis 4-sterigmatibus, clavatis, luteis, 25—30 × 5—6,5 μ.

Sterigmatibus rectis, brevibus, acutis, 5 μ longis.

Sporis cylindraceis vel ovato-cylindraceis, basi conoideo-attenuatis, glabris, luteis, ecolorata guttatis, 5,5—8,5 × 3,2—4 μ

Ad terram, Depok apud Buitenzorg, leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM — DE HAAS.

12. Clavaria Zollingeri LÉVEILLÉ,

(Annales des Sciences naturelles, Série 3, Vol. V 1846 p. 155)

Synoniemen:

Clavaria amethystina ZOLLINGER, non BULLIARD (Observationes phytographicae. Natuur- en Geneeskundig Archief voor Neêrland's Indië I, 1844 p. 381).

Clavaria Nymaniana HENNINGS (Monsunia I, 1900 p. 9).

Clavaria lilacea KUHL et VAN HASSELT (im Manuskript).

Abbildung:

Icones fungorum malayensium, Heft 4 Tafel IV Fig. 4, a-d.

Fruchtkörper verzweigt, bis 6 cm hoch, ganz hell oder prachtvoll tief amethystfarbig, bisweilen hell grauviolett, 1-4-mal dichotom verzweigt, ohne Strunk, Verzweigung sofort beim Boden anfangend und Aeste dort dicht zusammengedrängt oder Verzweigung erst auf einiger Distanz (1—3 cm) vom Boden anfangend. Äste stielrund oder etwas breitgedrückt, 0,5—3 mm breit, aufrecht, wenig divergierend, glatt, nach oben fast nicht dünner werdend, sehr gebrechlich, letzte Gabelung kurz und spitz oder länger und stumpf endigend. Bei tief gefärbten Exemplaren ist der Stiel heller gefärbt, bisweilen unten etwas bräunlich.

Basidien mit 4 Sterigmen, ziemlich kurz, oben stark angeschwollen, mit körnig plasmatischem Inhalt, 23—25 × 5—7 μ.

Sterigmen aufrecht, dünn und spitz.

Sporen farblos, mit plasmatischem Inhalt, glatt, zylindrisch-eiförmig, unten etwas schief zugespitzt, 4,5—6,5 × 2,5—3 μ.

Auf Erde, Hortus bogoriensis, wiederholt gefunden.

Nach der Originaldiagnose von LÉVEILLÉ sind die Fruchtkörper 3—4 cm hoch; Äste wenig zahlreich, dichotom verzweigt; Stiel kurz und glatt und Farbe rosa, übergehend in schön violett, was gut stimmt. Seine Angabe "ad truncos" ist aber zweifellos unrichtig, denn sie ist auch bei MORITZI (System. Verzeichniss, 1845—1846 p. 124) angeführt, wo „ad terram" hinzugefügt ist. Bei ZOLLINGER (System. Verzeichniss der im Indischen Archipel in den Jahren 1842—1848 gesammelten Pflanzen u. s. w., Zürich 1854 p. 12) wird über das Substrat nichts angegeben (Herb. proprium Zollingeri no. 99).

Die von ZOLLINGER angeführte *Cl. amethystina* (siehe oben) gehört zweifelsohne zu unserer Art. ZOLLINGER selbst sagt schon "an eadem species?" und seine Bemerkung "rami inferne simplices" deutet auch darauf hin. Er hat die Art auf Erde bei Tjikoja im Jahre 1843 gefunden; ob dieses Material von LÉVEILLÉ als *Cl. Zollingeri* beschrieben worden ist, lässt sich nur vermuten, weil dieser Autor die Nummer 992 und nicht 99 hinzufügt und Näheres über den Fundort nicht mitteilt.

Von NYMAN wurde die Art im hiesigen botanischen Garten auf Erde gesammelt und von HENNINGS als eine neue Art beschrieben. Die Beschreibung stimmt gut, nur hat er die Basidien etwas grösser gefunden. Die Sporenbeschreibung "subglobosis" und "hyalino-flavidulis" ist aber falsch.

Von *Cl. amethystina* FR. ist unsere Art durch die Art der Verzweigung und Farbe verschieden. Erstere hat auch viel grössere Sporen und Basidien. Auch *Cl. lilacina* FRIES (= *Cl. Schaefferi* SACC. = *Cl. purpurea* SCHAEFF. non Fl. Dan.) ist verwandt, hat aber rundliche, grössere Sporen (9 × 7—8 μ). *Cl. lilacina* JUNGH. ist eine auf Strünken wachsende, zweifelhafte Art, deren Namen jedenfalls geändert werden muss.

In der Sammlung Pilzabbildungen von KUHL und VAN HASSELT existiert von *Cl. Zollingeri* eine gute Abbildung unter dem Namen *Cl. lilacea*.

Die neuerdings von PETCH in den Annals of the Royal Bot. Garden of Peradeniya Vol. VII Part. IV p. 290 beschriebene *Cl violacea* hat keinen Wert, weil keine mikroskopischen Merkmale hinzugefügt sind. Auch ein Vergleich mit anderen violetten Arten fehlt vollständig. Für unsere heutige Pilzsystematik bilden dergleichen Beschreibungen einen unnötigen Ballast. Der Beschreibung nach zu urteilen ist sie wohl mit unserer Art identisch.

13. **Clavaria depokensis** V. OVEREEM nov. spec.

Abbildung:
Icones fungorum malayensium Heft 3 Tafel III Figur 4, a—b.

Fruchtkörper unverzweigt, zerstreut oder zu wenigen beisammen, 1—8 cm ang, 0,5—3 mm breit, stielrund und sehr schwach keulenförmig oder mehr oder weniger breitgedrückt und der Länge nach gefurcht, bisweilen fadendünn, aufrecht und starr oder buchtig und wurmförmig, oben stumpf abgerundet oder etwas verschmälert und stumpf zugespitzt, zuerst dunkel orange, schliesslich von den Sporen tief blutrot, Basis verschmälert und ganz unten weisslich mit weissem, kurzstrahligen Myzel.

Basidien mit 4 Sterigmen, farblos oder mit goldgelben Tropfen, keulenförmig, oben deutlich angeschwollen, 32—38 × 6—7,5 μ.

Sterigmen ziemlich gross, etwas abstehend aber nicht zangenförmig, bis 8,5 μ lang.

Sporen zylindrisch oder eiförmig, unten schief zugespitzt, mit einem, selten 2 goldgelben Öltropfen, schliesslich tief braunrot und zusammengeschrumpft, als körnige Kruste das Hymenium überdeckend.

Auf faulenden Blättern und Ästchen, Naturschutzgebiet "Depok" bei Buitenzorg, (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM-DE HAAS).

Eine merkwürdige Art, der *Clavaria luteo-tenerrima* V. OVEREEM im Habitus, Basidien und Sporen sehr ähnlich. Ob es sich bei den eckigen rotbraunen Gebilden wirklich um alte Sporen handelt, habe ich noch nicht einwandfrei beobachten können. Deutliche Uebergänge habe ich nicht gefunden. Eine andere Deutung der Entstehung habe ich jedenfalls nicht finden können.

Sie ist mit verschiedenen Arten verwandt, aber mit keiner habe ich sie identifizieren können. *Cl. helicoides* PAT. et DEMANGE ist ganz ähnlich, nur wächst diese Art auf Erde und von den Sporen wird nichts angegeben. Weiter kommen in Betracht *Cl. subfistulosa* HENN. (Farbe aber „pallide rufescens", Sporen mehr rundlich und auf Erde), *Cl. Cyatheae* HENN. (mehr fleischfarbig und anderen Stiel, Sporen mehr rundlich), *Cl. laeticolor* BERK. et CURTIS (stimmt gut, nur wird von den Sporen nichts angegeben), *Cl. tasmanica* BERK. (Sporen fast kugelig und grösser) und *Cl. miltina* BERK. (über die Sporen wird nichts angegeben). Der *Cl. laeticolor* BERK. et CURTIS steht sie am nächsten, ist wahrscheinlich mit dieser Art identisch.

Clavaria depokensis V. OVEREEM nov. spec.

Simplex, solitaria vel pauca congregata, 1—8 cm longa, 0,5—3 mm crassa, nunc teretiuscula et subclavata, nunc subcompressa et sulcata, rariter filiformis, erecta et rigida vel flexuosa et vermicularis, apice obtuse rotundata vel acute attenuata, basi attenuata et mycelio candido breve radiante munita, primo intense aurantiaca, postremo sanguinea.

Basidiis 4-sterigmatibus, clavatis, 32—38$\times$6—7,5 μ.

Sterigmatibus majusculis,-8,5 μ longis.

Sporis cylindraceis vel ovatis, basi oblique attenuatis, glabris, hyalinis, uni-, raro bi-luteoguttatis, postremo intense rufus.

Ad foliis ramulisque putridis.

Depok apud Buitenzorg, (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM-DE HAAS).

14. Clavaria implexa LÉVEILLÉ,

(Annales des Sciences naturelles, Série 3, Vol. V 1846 p. 154)

Abbildung:

Icones fungorum malayensium Heft 1 Tafel I Fig. 2, a.

Fruchtkörper korallenartig verzweigt, 8—10 cm hoch, ausserordentlich reich verästelt.

Strunk sehr kurz und dünn, etwa 1 cm hoch und nur wenige mm dick, schmutzig weiss, an der Basis mit zahlreichen weissen Myzelsträngen. Oben verzweigt sich der Strunk unregelmässig und reichlich und bildet zahlreiche fast gleich dünne, stark divergierende, zuerst fast horizontal verlaufende, bald aber sich rechtwinkelig umbiegende und dann aufrecht gehende Äste. Diese aufgehenden Äste sind wiederholt gegabelt, bei den Verzweigungen etwas breitgedrückt, Äste fast immer stark divergierend, Endzweige oft schön halbmondförmig und stark zugespitzt; Äste 0,5 – 2,5 mm dick, hell schmutzig fleischfarbig oder violettlich, im trockenen Zustande schmutzig grauweiss; Zweigspitzen dunkel violettbraun.

Basidien mit 4 aufrechten, spitzen Sterigmen, kurz, $22-24 \times 5,5$ μ.

Sporen elliptisch, bisweilen nach unten etwas verschmälert, farblos, rauh, $5-6,\ 5 \times 2,8-4$ μ.

Auf Erde zwischen Gräsern. Hortus bogoriensis, wiederholt von mir gefunden; Naturschutzgebiet „Depok" bei Buitenzorg, (leg. W. DOCTERS VAN LEEUWEN et C. et D. VAN OVEREEM - DE HAAS; R.C. BAKHUIZEN V.D. BRINK).

Eine typische Art, mit keiner anderen zu verwechseln.

Sie wurde zuerst von ZOLLINGER auf Java auf Erde gefunden und von LÉVEILLÉ beschrieben. Es ist eigentümlich, dass sie später nirgends erwähnt und auch nie wiedergefunden wurde, obschon sie im hiesigen botanischen Garten eine häufige Erscheinung ist.

Mit keiner europäischen Art zeigt sie Uebereinstimmung.

Die Beschreibung von LÉVEILLÉ stimmt gut, nur ist die Art nicht fleischig, sondern vielmehr etwas lederartig und zäh (lässt sich daher gut trocknen). In dieser Hinsicht nähert sie sich der Gattung *Lachnocladium*. Auch ihre rauhen Sporen und kurzen Basidien deuten auf diese Gattung hin.

15. **Clavaria sanguineo-acuta** v. OVEREEM nov. spec.

Abbildung:

Icones fungorum malayensium, Heft 3 Tafel III, Fig. 8, a.

Fruchtkörper unverzweigt, höchstens an der Basis verwachsen, dicht zusammengedrängt oder mehr zerstreut, bis 3 cm hoch, stielrund oder etwas breitgedrückt und dann gefurcht, etwas gebogen, nach oben deutlich verschmälert und fast zugespitzt, unten breit auf der Erde sitzend, leuchtend blutrot, im Alter verblassend, bisweilen fadendünn, 0,5 – 3 mm dick, innen etwas hohl. Basidien mit 3—4 Sterigmen, ziemlich kurz, oben schwach angeschwollen, farblos, $32-41 \times 5-7$ μ, sich im Reifezustand deutlich über das Hymenium emporhebend.

Sterigmen aufrecht, scharf zugespitzt, 8 μ lang.

Sporen kugelig, mit kegelig ausgezogener Anheftungsstelle, glatt, farblos, mit einem grossen Öltropfen, 4—5 μ i. D.

Hymenium ziemlich locker, fast unmittelbar sich dem inneren Gewebe anschliessend.

Das innere Gewebe ist fast parenchymatisch und besteht aus parallelen, stark septierten Hyphen mit deutlichen Schnallen und zahlreichen kleinen,

eckigen, roten Körnchen, welche sich mit Schwefelsäure blauviolett und mit Jod grünblau färben, was auf Karotin hindeutet.

Auf Erde, Hortus bogoriensis, zuerst von Direktor Dr. W. DOCTERS VAN LEEUWEN und später auch von mir an derselben Stelle gesammelt.

Eine prachtvolle Art, der *Clavaria cardinalis* BOUDIER et PATOUILLARD verwandt, sowohl im Habitus wie in den anatomischen Merkmalen. *Cl. cardinalis* ist aber durch ihre mehr stumpfen, unten verschmälerten und breiteren Fruchtkörper und durch ihre etwas grösseren Sporen (5—7 μ i.d.) verschieden Die Basidien sind meistens 3-sporig, 4-sporige kommen auch oft vor, 2-sporige Basidien sind selten.

ZOLLINGER und MORITZI (Natuur- en Geneeskundig Archief voor Neêrland's Indië I 1844 p. 381) haben von Java ebenfalls eine blutrote *Clavaria*, *Clavaria phoenicea*, beschrieben, welche aber infolge ihrer grossen, fleischigen Fruchtkörper hier wohl nicht im Frage kommt. Vielleicht handelt es sich hier gar nicht um eine *Clavaria*.

Clavaria sanguineo-acuta V. OVEREEM nov. spec.

Simplex, gregaria vel subsparsa, usque ad 3 cm alta, cylindracea vel subcomplanata et sulcata, subcurvata, apice conspicue attenuata et subacuta, basi dilatata, pulcherrime sanguinea, postea pallescens, 0.5-3 mm crassa.

Basidiis 2—4 sterigmatibus, subbrevibus, supra subdilatatis, hyalinis, intus subcava, 32—41 $\times$ 5—7 μ.

Sterigmatibus rectis, acuminatis, usque ad 8 μ longis,

Sporis globosis, hyalinis, uniguttatis, levibus, 4 - 5 μ diam.

Ad terram, Hortus Bogoriensis, (leg. W. DOCTERS VAN LEEUWEN; ibid. leg. C. V. OVEREEM).

16. Clavaria alcicornis ZOLLINGER et MORITZI,

(Natuur- en Geneeskundig Archief voor Neêrland's-Indië, I, 1844 p. 382)

Abbildung:
Icones fungorum malayensium, Heft 4 Tafel IV, Fig. 2, a—b.

Fruchtkörper korallenartig verzweigt, zerstreut oder in kleinen Rasen wachsend, 2,5—8 cm hoch.

Strunk kurz und dick oder lang stielartig, bisweilen an der Basis verdickt, nach oben breiter werdend und etwas breitgedrückt und gefurcht, fleischfarbig, nach unten blasser und die Basis weisslich, bisweilen flockig weiss und etwas niederliegend, 1—3 cm lang, 1—5 mm dick. Äste 2—mehrfach dichotom oder mehr unregelmässig verzweigt, stielrund, aber meistens breitgedrückt und gefurcht, bei den Verzweigungen breiter werdend, aufstrebend und wenig divergierend, Ästchen in dichter Masse zusammengedrängt oder mehr lose stehend, sehr verschieden lang und dick, schön crême-rosa oder mehr hell fleischfarbig, von den Sporen ocker-fleischfarbig bestaubt; Endzweige kurz und stumpf, gerade oder zangenförmig gebogen.

Gipfel prachtvoll rötlich, aber auch wohl schmutzigbraun oder gar nicht abweichend gefärbt.

Fleisch weiss, etwas zäh, schmeckt süsslich. Kein auffallender Geruch.

Basidien mit 2—4 Sterigmen, sehr verschieden lang, unten stielförmig verschmälert, mit öligem Inhalt, 38—75 × 5—8 μ, reife Basidien nur wenig das Hymenium überragend.

Sterigmen meistens 3, auch 2 oder 4, aufrecht, sehr verschieden lang, entweder unten blasig angeschwollen oder mehr fadenförmig, 5—17 μ lang.

Sporen kugelig, glatt, mit aufgesetztem Spitzchen für die Anheftung, schwach fleischfarbig und mit farblosem Öltropfen, 4—6,5 μ i. D.

Hyphen des inneren Gewebes septiert, farblos, mit Schnallen, oft stark gewunden.

Auf Erde, Hortus bogoriensis, wiederholt gefunden.

Im Habitus eine variable Art, welche durch die kugeligen Sporen und wechselnde Sterigmenzahl gut in die *Clavaria amethystina*- Gruppe passt.

Die Identifizierung mit *Cl. alcicornis* ZOLL. et MOR. ist etwas zweifelhaft, weil eine auffallende Farbe fehlt und es kaum möglich ist, ohne mikroskopische Angaben Sicherheit zu erlangen; ausserdem ist die Variabilität im Habitus zu gross. ZOLLINGER hat die Art bei Tjikoja, W. Java, auf Erde gefunden (Herb. normale No. 1125). Sie ist aufgenommen in den Artenverzeichnissen bei MORITZI (System. Verzeichnis, 1845—1846 p. 124) und ZOLLINGER (System. Verzeichn. 1854 p. 12).

CLAVARIELLA KARSTEN,

17. Clavariella fragillima (HENNINGS) v. OVEREEM nov. comb.

Synoniemen:

Clavaria echinospora HENNINGS (Monsunia I 1900 p. (43) 141).

Clavaria fragillima (HENNINGS) Saccardo et Sydow (Sylloge Fungorum Vol. XVI 1902 p. 206).

Abbildung:

Icones fungorum malayensium, Heft 1 Tafel I Fig. 3, a.

Fruchtkörper 3—9 cm hoch, sehr verschieden gestaltet, entweder dicht korallenartig verzweigt oder nur ein Hauptstamm, oben mit zahlreichen dünnen Seitenzweigen. Zwischen diesen extremen Formen gibt es alle Übergänge. Strunk dünn, stielförmig, als Hauptstamm sich verlängernd und nach oben allmählig dünner werdend oder dick und fleischig und oben in zwei oder mehr dicke Äste sich auflösend und dort etwas breitgedrückt, oft deutlich wurzelnd, fleischfarbig oder gelbbraun, unten weiss oder schmutzig weiss, 1—4 cm lang, 2,5—6 mm dick; Wurzel bis 3,5 cm lang.

Äste entweder dünn und kurz, einfach und auf verschiedener Höhe aus den Hauptstamm entspringend oder wiederholt dichotom oder mehr unregelmässig verzweigt, die dicken unteren zuerst etwas divergierend, die oberen nach der Verzweigung sofort aufstrebend, rost-oder gelbbräunlich,

von den Sporen hell rost-oder ockergelb bereift; Zweigspitze immer stumpf, verschmälert und einfach oder kurz gegabelt, auf sehr verschiedener Höhe endigend, bisweilen purpurbraun; Aeste 1,5—2,5 mm dick, von sehr verschiedener Länge, bei den fast unverzweigten Exemplaren etwa 0,5 mm dick.

Sporenstaub rostbraun, trocken mehr ockergelb. Fleisch weiss, später mehr schmutzig fleischfarbig.

Basidien mit 4 grossen, aufgehenden Sterigmen, nach unten wenig verschmälert, farblos, 60—70 × 6—7,5 μ.

Sporen eiförmig, tief ockergelb, kurz und stumpf stachelig, mit farbloser, ausgezogener, stumpfer Anheftungsstelle, 9—11 × 5—6 μ.

Auf Erde, Hortus bogoriensis, wiederholt gefunden.

Die Art ist mit kleinen Exemplaren von *Phaeoclavulina Zippelii* (LÉV.) V. OVEREEM zu verwechseln, aber durch die kleineren, kurzstacheligen Sporen und 4-sporigen Basidien gut verschieden. Auch die Farbe des Sporenstaubs ist dort mehr dunkel zimtbraun.

Sie wurde zuert von NYMAN im hiesigen botanischen Garten auf Erde gefunden und von HENNINGS beschrieben. Die Diagnose stimmt gut, nur sind seine Sporenmassen etwas kleiner (7—8 × 4—5 μ) und ist die Farbe nicht „atroferrugineis". Weil eine *Clavaria echinospora* schon von BERKELEY and BROOME von Ceylon beschrieben wurde, musste der Name geändert werden.

PHAEOCLAVULINA Brinkmann,

18. Phaeoclavulina Zippelii (LÉV.) V. OVEREEM nov. comb.

Synoniemen:

Clavaria Zippelii LÉVEILLÉ (Annales des Sciences naturelles, Bot, Série 3, Vol. II 1844 p. 215).

Clavaria cyanocephala BERKELEY et CURTIS (Journal of the Linnean Society, Botany, Vol. X 1868 p. 338).

Clavaria aeruginosa PATOUILLARD (Bulletin de la Société mycolog. de France, Vol. XIV 1898 p. 189).

Clavaria Dozii LÉVEILLÉ (Annales des Sciences naturelles, Bot., Série 3 Vol. II 1844 p. 216).

Abbildung:

Icones fungorum malayensium, Heft 1 Tafel I, Fig. 1, a-c.

Fruchtkörper korallenartig verzweigt, gewöhnlich 10—13 cm hoch, aber oft auch viel grösser, einzeln oder einige dicht beisammen, bisweilen riesige kompakte Massen bildend.

Strunk gut ausgebildet, gleich dick oder nach oben breiter werdend, fleischig, hell rotbräunlich mit einem Stich ins blaue oder mehr schmutzig violettlichdunkelbraun, 6—15 mm dick, 3—6 cm lang, oben sich mehr oder

weniger unregelmässig in einige dicke Äste verzweigend. Äste sich wiederholt dichotom oder mehr unregelmässig verzweigend, aufstrebend, nach oben immer mehr aufeinandergedrängt, bisweilen aber die ersten Verzweigungen wenig aufgehend und ziemlich lose, 1—5 mm dick, gleichfarbig wie der Strunk oder mehr hell rötlichbraun oder bläulich. Zweigende stumpf, grauweiss oder etwas bläulich; beim vollständigen Auswachsen mit zwei oder mehr halbmondförmigen, spitzen, prachtvoll blau gefärbten Zweigspitzen. Der ganze Fruchtkörper, der Strunk ausgenommen, wird von den Sporen schliesslich tief zimtbraun gefärbt.

Fleisch fest, schmutzigweiss.

Basidien mit 2 Sterigmen, in einen langen Stiel verschmälert, zuerst farblos, schliesslich mit ockergelbem, körnigen Inhalt, etwa $40 \times 5{,}5—9\ \mu$.

Sterigmen gross, schief abstehend, aber nicht zangenförmig, — 10 μ lang.

Sporen lang elliptisch, unten stark verschmälert und gekrümmt, hell ockergelb, dicht und lang stachelig, Anheftungsstelle glatt und farblos, $10—15 \times 5—8\ \mu$.

Die blauen Zweigspitzen sind bekleidet mit palissadenförmigen Zellen mit blauem oder grünblauem Inhalt, etwa $20 \times 4{,}5—5{,}5\ \mu$.

Auf Erde zwischen Humusteilen.

Hortus bogoriensis, wiederholt in grossen Mengen gefunden; bei Tjibodas, G. Gede, W. Java, im Urwalde, 2000 m (leg. W. DOCTERS VAN LEEUWEN, P. DAKKUS et A. BRUGGEMAN); Tjidadap, Tjibèbèr, Preanger, Java, 1000 m (leg. R. C. BAKHUIZEN V. D. BRINK, No. 1690); Holländisch Neu-Guinea, bei Prauwenbivak, Expedition 1920—1921, (leg. Dr. H. J. LAM, no. 1167); Boeroe (leg. L. J. TOXOPEUS).

Eine häufige Art, in allen tropischen Gegenden verbreitet. Sie ist jetzt bekannt vom malayischen Archipel, Neu-Guinea, Cuba Philippinen und den Boninninseln.

Die Gattung *Phaeoclavulina* wurde von BRINKMANN (Jahresberichte des Westfälischen Prov. Vereins für Wissenschaft und Kunst, Bot. Sect. 1896—'97 p. 197) für 2-sporige *Clavariella*-Arten aufgestellt. Seine *Phaeoclavulina macrospora* ist unserer Art sehr ähnlich. Auch hier handelt es sich um eine grosse, fleischige, reich verästelte Art mit zweisporigen Basidien und elliptischen, grossen, ockerfarbigen, rauhen Sporen. Nur sind die Sporen nicht stachelig sondern rauh.

Zu der Gattung *Phaeoclavulina* gehört weiter auch die *Clavaria Broomei* COTTON et WAKEFIELD (Transactions of the British Mycological Society, Vol. VI Part. II 1919 p. 170) mit zweisporigen Basidien und grossen, elliptischen, stacheligen, ockerfarbigen Sporen. Durch die mehr orange Farbe und ganz anders gefärbten Zweigspitzen ist diese Art von *Ph. Zippelii* verschieden. Anatomisch gibt es zwischen beiden Arten keine Unterschiede. Die Art hat *Phaeoclavulina Broomei* (COTTON et WAKEFIELD) v. OVEREEM zu heissen.

Obenstehende drei Arten bilden mit der Gattung *Phaeoclavulina* eine gute natürliche Gruppe.

Ph. Zippelii wurde zuerst vom Obergärtner ZIPPEL auf dem G. Gede, W. Java, gefunden und von LÉVEILLÉ beschrieben.

Zippel gibt an, dass die Art unter dem einheimischen Namen "magan" (muss sein "majang" (Soend.) = Geschlechtshaaren) bekannt ist und von den Eingeborenen gegessen wird. Hier in Buitenzorg wird sie nicht konsumiert. Ich habe mich immer darüber gewundert, weil es sich um eine grosse, fleischige, häufige, jedenfalls gut essbare Art handelt, welche an unsere grossen europäischen Ziegenbärte erinnert.

Clavaria Dozii LÉV. gehört auch wohl zu unserer Art. Die Beschreibung stimmt gut mit einem getrockneten Exemplar. Die *Clavariella fragillima* (HENN.) v. OVEREEM kommt hier nicht in Betracht, denn LÉVEILLÉ beschreibt den Sporenstaub als kastanienbraun, während er bei letztgenannter Art hell rostfarbig ist.

Vielleicht ist auch die *Clavaria echinospora* BERKELEY et BROOME (Journ. of the Linnean Soc., Botany, Vol. XIV p. 75) von Ceylon identisch. Leider fehlen bei dieser Art Angaben über die Sporengrösse. Die Autoren geben sie wohl für *Cl. megalorhiza* (5—6 × 2,5—4 μ) und sagen, dass die Sporen von *Cl. echinospora* grösser sind, welche Angabe meine Vermutung verstärkt. Die Synonimie unserer Art mit *Clavaria cyanocephala* BERK. et CURT. und *Cl. aeruginosa* PAT. wurde schon durch VON HÖHNEL aufgeklärt (Fragmente zur Mykologie, VI. Mitteilung no. 192, Sitzungsberichte der kaiserl. Akad. d. Wissensch. in Wien, Mathem.-naturw. Klasse, Bd. CXVIII Abt. I 1909 und X. Mitteilung no. 469, ebend. Bd. CX IX Abt. I 1910). Von *Cl. cyanocephala* hat er das Originalexemplar aus dem Kewherbarium gesehen. Weiter macht dieser Forscher auch Bemerkungen über die blaue Farbe, welche meiner Meinung nach unrichtig sind. Bei den Exemplaren, welche im hiesigen botanischen Garten wachsen, ist von einer blauen Farbe fast nie etwas zu sehen. Bisweilen sind die Exemplare hier und da etwas blaugrün, nicht nur ganz oben sondern auch an den dickeren Ästen und am Strunk. Formen mit schönen, blauen Gipfeln habe ich hier unter den zahlreichen Exemplaren, welche mir zu Gesicht kamen, nie gefunden.

Das Blau tritt erst an den Gipfeln vollständig ausgewaschsener Exemplare auf, wo die kurzen, zugespitzten Endzweige gut ausgebildet sind. Die Exemplare in Buitenzorg sind nie ausgewachsen und ihre Gipfel daher auch nicht blau gefärbt. Nach VON HÖHNEL sind die Exemplare mit blauen Spitzen nicht ausgewachsen, aber die Sache verhält sich gerade umgekehrt.

Auch die Angabe von VON HÖHNEL, dass die Sterigmen zangenförmig sind, ist unrichtig. Zwar sind sie etwas abgebogen, aber zangenförmig, wie dies bei den *Clavulina*-Arten vorkommt, sind sie nicht.

Clavulinopsis v. OVEREEM nov. gen.

Am Schluss möchte ich hier eine eigentümliche, weisssporige Form besprechen, welche sich weder bei *Clavulina*, noch bei *Clavaria* unterbringen lässt. Mit *Clavulina* hat sie nichts zu tun, daher sind ihre Merkmale nur denjenigen von *Clavaria* gegenüberzustellen. Der Hymeniumbau und die

Basidienform stimmen mit dem stichobasidialen Typus überein. Die Basidien zeigen ganz eigentümliche Merkmale; sie sind 1—4 sporig, sehr verschieden lang und die Sterigmen sind sehr verschieden entwickelt und oft in verschiedener Höhe entspringend. Leider sind die zytologischen Verhältnisse noch nicht bekannt, sodass ihr Platz im System vorläufig zweifelhaft bleibt. Wird meine Vermutung über ihre stichobasidiale Natur bestätigt, so steht sie ganz vereinzelt da und lässt sich am besten den *Cantharellales* anreihen.

19. Clavulinopsis sulcata V. OVEREEM nov. spec.

Abbildung:
Icones fungorum malayensium Heft 2 Tafel II Fig. 3, a-b.

Fruchtkörper unverzweigt, bis 6 cm hoch, bündelartig wachsend, hell rot, etwas bandförmig, hin und her gebogen, oft etwas unregelmässig, oben stumpf, unten stielartig verschmälert, oben nur seicht, unten tief gefurcht, bis 6 mm breit.

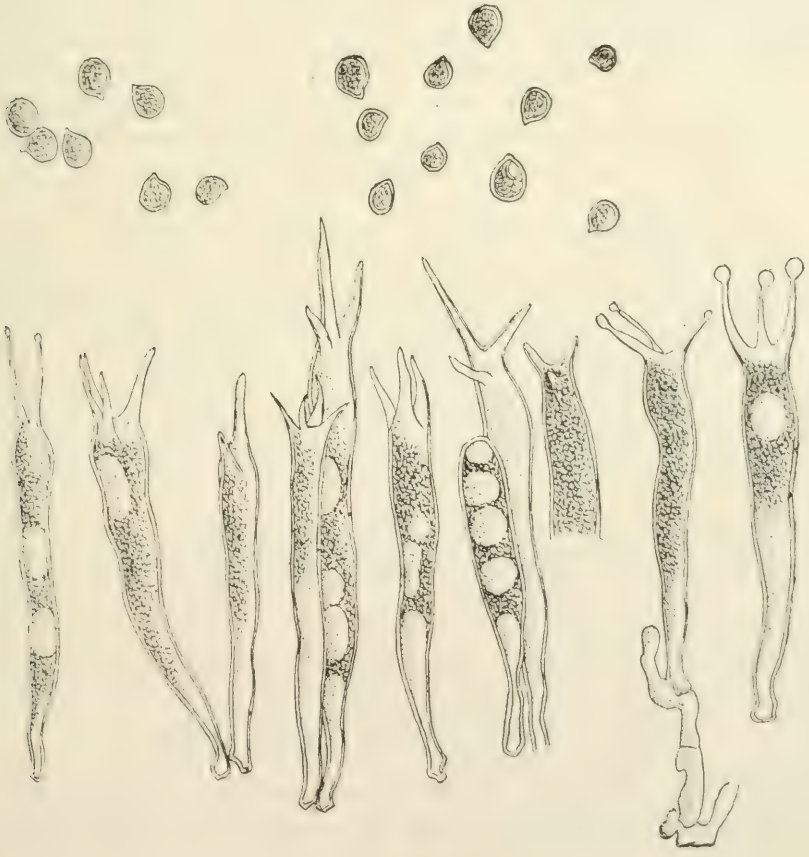


Abbildung 4.

Basidien mit 1—4 Sterigmen, schlauchförmig, unten nur schwach verschmälert, oben nicht angeschwollen, mit plasmatischem Inhalt, sehr ungleich lang, 45—75×5,5—8 μ.

Sterigmen meistens 3, oft 4 oder 2, selten 1, sehr verschieden lang, kegelförmig, an demselben Basidium oft sehr verschieden ausgebildet, bisweilen auf etwas verschiedener Höhe entspringend, 8—20 μ lang.

Sporen kugelig, mit kegelförmig ausgezogener Anheftungsstelle, glatt, farblos, mit plasmatischem Inhalt, ohne Öltropfen, 4—5,7 μ i. D.

Hymenium geschlossen, in basifugaler Richtung weiterwachsend, hier und da mit eingestreuten Sporen; reife Basidien nur wenig das Hymenium überragend. Die Basidien entspringen einem subhymenialen Gewebe, dessen Zellen deutliche Schnallen besitzen und senkrecht zur Oberfläche, also in der Richtung der Basidien verlaufen. Hymenium und Subhymenialgewebe zusammen etwa 150 μ dick. Das innere Gewebe besteht aus längsverlaufenden, farblosen, septierten Hyphen, 4,5—9 μ i. D.

Auf Erde, Hortus bogoriensis, von mir gesammelt.

Eine eigentümliche Art, welche mit anderen roten Arten nur oberflächlich Uebereinstimmung zeigt.

Am meisten bemerkenswert sind die Sterigmen. Wenn drei Sterigmen vorhanden sind, stehen sie entweder normal in einem Dreieck oder in einer Reihe oder eine entspringt etwas niedriger. Ihre verschiedene Länge am selben Basidium ist ebenfalls sehr merkwürdig und kann als primitives Merkmal betrachtet werden. Das Vorkommen eines einzigen Sterigmas habe ich noch bei keinem anderen Pilz beobachtet.

Clavulinopsis sulcata V. OVEREEM nov. spec.

Simplex, usque ad 6 cm alta, fasciculata, dilute rubra, fasciata, flexuosa, saepe subirregularia, ad apicem obtusa et subsulcata, ad basem pedicelliforme attenuata et profunde sulcata, usque ad 6 mm lata.

Basidiis 1—4-sterigmatibus, tubuliformibus, basi subattenuatis, valde inaequilonga, 45—75 × 5,5—8 μ.

Sterigmatis plerumque 3, saepe 4 vel 2, raro 1, valde inaequilongis, (8—20 μ).

Sporis globosis, hyalinis, eguttatis, 4—5,7 μ diam.

Ad terram, Hortus bogoriensis (leg. C. VAN OVEREEM).

Erklärung zu Abbildung 4:
Basidien mit verschiedener Sterigmenzahl und Sporen 850/1.

6. Ueber einige Rumphianische Arten.

Die Pilzbeschreibungen bei RUMPHIUS (Herbarium Amboinense VI) sind mit wenigen Ausnahmen für die Wissenschaft ebensoviele Rätsel geblieben. Obschon man zugeben muss, dass die Beschreibungen bisweilen etwas rätselhaft sind, hat doch zum grössten Teil die Tatsache, dass meistens ausländische Forscher, die den alt-holländischen Text nicht verstanden, sich bemüht haben, diese Arten zu erkennen, Schuld daran. Viele Arten sind trefflich charakterisiert, es kommt nur darauf an, jedes Wort richtig zu verstehen.

Der bekannte Botaniker E. D. MERRILL auf den Philippinen hat eine Zusammenstellung der Rumphianischen Arten gegeben (An Interpretation of RUMPHIUS's Herbarium Amboinense, Manila 1917), in welcher er auch die Pilze aufgenommen hat. Es ist ihm aber nicht gelungen, ein einziges dieser Pilzprobleme einwandfrei zu lösen; er beschränkt sich nur auf Mutmassungen über die Zugehörigkeit.

Zwei Tatsachen gibt es, welche eine Lösung dieser Probleme sehr gut möglich machen. Erstens hat man zu bedenken, dass die von RUMPHIUS beschriebenen Arten selbstverständlich keine Seltenheiten, sondern häufig vorkommende Formen sind. Sie sind der einheimischen Bevölkerung gut bekannt und jede hat irgendeinen Nutzen. Zweitens hat RUMPHIUS von jeder Art auch den einheimischen Namen gegeben und, weil auf diesen ziemlich isolierten Molukken-Inseln in Sitten und Gebräuchen fast nicht eingegriffen wurde, ist es möglich, an Hand der einheimischen Namen die richtige Art zu bekommen.

Direktor HEYNE des hiesigen Museum für Ökonomische Botanik hat sich seit vielen Jahren bemüht, die Arten an ihren ursprünglichen Fundorten an Hand der schon van RUMPHIUS angegebenen einheimischen Namen sammeln zu lassen. Dadurch ist es möglich gewesen, die folgenden Rumphianischen Rätsel zu lösen,

a. Fungus arborum tuberosus RUMPHIUS.

„De Bolachtige Boom-Campernoelje".

(Het Amboinsch Kruid-boek, Sesde deel p. 130 Tab. LVI Fig. VI.)

Nach MERRILL (s.o. p. 61) handelt es sich hier wohl um ein *Lycoperdon*. Wenn man aber die holländische Beschreibung genau liest, bemerkt man, dass ganz etwas anderes vorliegt. Tatsächlich handelt es sich hier um *Daldinia concentrica* (BOLT). CES. et DE NOT. Dafür spricht aus der Beschreibung folgendes: „het zijn ronde en langwerpige bollekens (es sind runde oder längliche Ballen); zonder steelen, digt tegen de schorsse der bomen zittende (ohne Stiele, auf der Rinde der Bäume dicht aufsitzend); buiten effen, glad, purperagtig van couleur (aussen eben, glatt, purpurfarbig); als men ze wat hard strijkt, zoo werden ze zwart (!) gelijk ook doorgaans de binnenste substantie is (wenn man sie reibt, werden sie schwarz [1]) ebenso wie die innere Substanz); substantie eerst masief, droog, en bros (Substanz zuerst massiv (!), trocken und spröde (!) [2]); men vindt ze aan bomen (auf Baumrinde!)". Die beigegebene Figur ist zwar ziemlich unverständlich, spricht aber viel mehr für *Daldinia* als für ein *Lycoperdon*. Die Art spielt in der einheimischen Heilkunde eine Rolle, welche auf der hygroskopischen Wirkung des Pilzgewebes beruht. Nach RUMPHIUS werden die Fruchtkörper zerrieben und mit Essig zu einem Brei zubereitet. Diesser wird zum Auftrocknen von Ringwurm und anderen Geschwülsten (z. B. Banca babi) benützt.

HEYNE (De Nuttige Planten van Nederlandsch-Indië, I Herdruk 1922 p. 7) gibt an, dass auf der Insel Tidore die Asche gegen Kopfgeschwüre

[1]) Ist ganz typisch für *Daldinia* und wäre bei einem *Lycoperdon* nicht möglich.
[2]) Kann man doch niemals von einem *Lycoperdon* sagen.

gebraucht wird. Hieraus geht hervor, wie durch fast drei Jahrhunderte der eigentümliche Gebrauch derselbe geblieben ist. Auf Ternate heisst die Art „Bio-bio", auf Tidore „Tabobi". Auf letztgenannter Insel wurde die Art unter diesem Namen in grosser Menge gesammelt.

Daldinia concentrica ist eine der häufigsten tropischen Pilzarten. Auf Stämmen und faulendem Holz ist sie im ganzen Archipel in grossen Mengen zu finden und an Häufigkeit vielleicht der *Xylaria Hypoxylon* in Europa, wo sie zu den seltenen Erscheinungen gehört, gleich zu stellen.

Ihre Benützung in der einheimischen Heilkunde steht nicht einzeln da. Von vielen anderen Vertretern der *Xylariaceae* ist etwas ähnliches bekannt.

Ich möchte hier noch auf eine Eigentümlichkeit der Art hinweisen, welche zur Aufstellung einer neuen Art, *Daldinia Asphaltum* (LINK et FR.) SACC. Veranlassung gab. Bisweilen sind die Exemplare mit einer Lackkruste überdeckt; besonders wenn sie in Alkohol gelegen sind, werden sie glänzend schwarz. Vielleicht werden bei diesem Prozess harzartige Stoffe ausgezogen, welche sich als eine Kruste ansetzen. Dies dürfte bei Exemplaren der Fall gewesen sein, welche durch LEE von den Philippinen an LLOYD zugeschickt worden sind. Es ist also überflüssig den Namen *D. Asphaltum* aufrecht zu halten, wie LLOYD dies getan hat (Mycological Notes No. 66 1922 p. 1133).

Fundorte: Sabang, N. Sumatra (leg. C. et D. VAN OVEREEM- DE HAAS); Insel Sebesie, zwischen Java und Sumatra (leg. W. DOCTERS VAN LEEUWEN); Hortus bogoriensis; Insel Edam und Klein Kombuis, N. W. Küste von Java (leg. W. DOCTERS VAN LEEUWEN); Ternate und Halmaheira, Molukken (leg. BEGUIN); Pasir Waringin, Res. Bantam, Java (leg. A. STEINMANN).

b. Crepitus Lupi RUMPHIUS.

De regte Crepitus lupi of Bovis.

(Het Amboinsch Kruid-boek, Sesde deel p. 131).

Zweifelsohne handelt es sich hier um ein *Lycoperdon;* schon von HASSKARL (Neuer Schlüssel zu RUMPH's Herbarium amboinense, Abhandl. der Naturf. Gesellschaft in Halle Bd. IX 1866 p. 316) angegeben. Auch MERRILL (s.o. p. 60) hat sich dieser Meinung angeschlossen. In der Beschreibung gibt es einige Angaben, welche darauf hinweisen, dass RUMPHIUS hier das *Lycoperdon Bovista* L. gemeint hat. Dafür spricht folgendes: „zommige als een vuist, zommige als een kinderhoofd" (von der Grösse einer Faust bis eines Kinderkopfs, also handelt es sich um eine grosse *Lycoperdon*-Art und, weil er als Fundorte hinzufügt Wiesen und offene Stellen in den Bergen, kommt nur *L. Bovista* in Betracht).

Obschon die Art nicht gerade häufig vorkommt, ist sie doch oft auf Java gefunden worden und zwar immer auf Wiesen.

In der einheimischen Heilkunde spielt sie eine ähnliche Rolle wie *Daldinia concentrica*. Aus dem reifen inneren Gewebe wird mit Essig eine Salbe bereitet und zum Aufschmieren auf Geschwülsten und auf geschwollenen Körperteilen gebraucht, wo es eine wasserentziehende Wirkung hat. Auch wird es gegen Syphilis verwendet (KLOPPENBURG, J. Indische Planten en haar geneeskracht, Semarang 1909 p. 177).

Auf Java heisst die Art „djamoer impês" (djamoer = Pilz; impês = Blase eines Büffels (jav.), aber dieser Name wird auch für verwandte *Lycoperdon*-Arten gebraucht. Auf Soela (Molukkeninseln) wird sie nach RUMPHIUS als „fata goma" (= Mistkoncretionen) bezeichnet.

c. Boletus moschocaryanus RUMPHIUS.

(Het Amboinsch Kruid-boek, Sesde deel p. 124).

Nach MERRILL (s. o. p. 60) handelt es sich hier wohl um einen *Lentinus*. Die Beschreibung von RUMPHIUS spricht aber gar nicht dafür. Auch wächst die Art nicht, wie MERRILL angibt, auf *Myristica*-Stämmen, sondern wird von den Eingeborenen auf *Myristica*-Fruchtschalen gezüchtet. Tatsächlich handelt es sich hier um *Volvaria volvacea* (BULL.) FR. Die Art war in den Sammlungen des Museums für Ökonomische Botanik vertreten und wurde auf Ambon gesammelt. Für weitere Einzelheiten siehe bei *Volvaria volvacea*.

d. Boletus saguarius RUMPHIUS.

(Het Amboinsch Kruid-boek, Sesde deel p. 124)

Wächst nicht, wie MERRILL (s. o. p. 60) angibt, auf faulender Rinde der Sagopalmen, sondern auf dem faulenden Markgewebe, wo die Stärke ausgezogen worden ist. Auch hier handelt es sich um *Volvaria volvacea* (BULL.) FR. Sie wurde neuerdings auf Halmahera unter dem einheimischen Namen „kala tèmoko" (schon von RUMPHIUS angegeben) eingesammelt. MERRILL hat sie aus der Beschreibung als eine *Agaricacee* erkannt. Für weitere Einzelheiten siehe bei *Volvaria volvacea*.

7. Ueber Geotrichum Zingiberis saccharati V. OVEREEM n. sp.

Auf Ingwerstücken, welche etwas lang aufbewahrt waren, bildete sich schliesslich eine Pilzvegetation, in welcher sofort zwei Arten zu unterscheiden waren. Zum Teil waren die Stücke mit grünen gestielten Köpfchen bedeckt, welche als *Aspergillus glaucus* (L.) LINK, eine Art, welche bis jetzt in der Pilzliteratur von Niederländisch Indien nicht bekannt war, bestimmt wurden. Während in Europa bei Verschimmelung der verschiedensten Sachen diese Art auftritt, ist es in den Tropen mehr *A. flavus* LINK, welcher man begegnet.

Die zweite Art war ein *Geotrichum*, welches sich besonders schön an den Schnittflächen entwickelte. Bis jetzt sind keine *Geotrichum*-Arten für das Gebiet bekannt. Von den wenigen europäischen Arten war unsere Art deutlich verschieden.

Die Beschreibung ist folgende:

Rasen bis 1,5 mm i. D., flach polsterförmig, schmutzigweiss, bis crêmeweiss, rund, zerstreut, wenig zusammenfliessend, direkt auf den Ingwerstücken (nicht auf den Zuckerkristallen).

Konidienträger farblos, buchtig, dicht aufeinander, mit protoplasmatischem Inhalt, seitlich dem septierten Myzell entspringend, meistens unseptiert, an ihren oberen Enden die Konidien in einer Kette tragend, bisweilen dichotom verzweigt, sehr verschieden lang (im Durchschnitt 53—60 μ) und 1,7—2,3 μ breit. Am oberen Ende entstehen die Septen zuerst in grossen Distanzen, dann werden zwischen diesen wieder neue gebildet, sodass

schliesslich kubische Zellen entstehen. Diese runden sich an den Ecken etwas ab, bleiben aber noch lang in einer Kette beisammen.

Myzell stark septiert, farblos, Zellen oft tonnenförmig aufgeblasen, bis 7 μ breit.

Konidien kubisch mit abgerundeten Ecken, bisweilen entweder in der Länge oder Breite etwas prismatisch, 2,3—3,5 μ i. D., farblos.

Im Habitus dem *G. candidum* LINK ähnlich, aber die Konidien sind hier überwiegend rein kubisch und viel kleiner. *G. cinereum* BON. hat ganz andere Träger.

Geotrichum Zingiberis saccharati V. OVEREEM n. sp.

Acervuli usque 15 mm diam., plane pulvinati, sordide albi, dispersi, rotundati.

Conidiophorae sine colore, crebrae, e mycelio septato lateraliter enascentes, non septatae, apice conidia in catenam disposita formantes, 50—60 × 1,7—2,3 μ.

Conidia cuboidea, rotundato-angulata, sine colore, 2,3—3,5 μ diam.

In Zingiberi saccharato, Buitenzorg, leg. C. VAN OVEREEM.

8. Ueber Clasterosporium Glomerae v. OVEREEM nov. spec.

Auf *Glomera*-Arten (*Orchidaceae*) von Neu Guinea gibt es nicht selten auf Stengeln und Blättern eine feine, wenig dichte Haarbildung, welche mit dem unbewaffneten Auge noch deutlich zu sehen ist. Von Dr. J. J. SMITH wurde ich auf diese Erscheinung aufmerksam gemacht, denn nach ihm handelte es sich hier wahrscheinlich um einen Pilz, welche Vermutung ich bestätigen konnte. Das Material wurde mir von Dr. SMITH mit grosser Liebenswürdigkeit zur Verfügung gestellt. Nach ihm sind diese Pilzrasen in einigen Fällen von Ochideenforschern als Haarbildungen beschrieben worden.

Eigentümlich ist, wie die Ästchen und Blätter bisweilen gänzlich vom Pilz befallen sind, sodass dieser sich tatsächlich als eine regelmässige Haarbildung zeigt. Bei 50-facher Vergrösserung tritt aber die Pilznatur deutlich zur Tage.

Ich konnte das Material untersuchen an Exemplaren von *Glomera subuliformis* J. J. SMITH, von VON RÖMER auf der Neu Guinea-Expedition 1909 an der Nordrivier gesammelt und an *Gl. uniflora* J. J. SMITH, im Jahre 1907 von G. VERSTEEG gefunden. Dies weist schon darauf hin, dass der Pilz auf *Glomera*-Arten eine häufige Erscheinung ist.

Die Beschreibung ist folgende:

Myzel wenig entwickelt, hellbraun, septiert, typisch rechtwinkelig verzweigt; Hyphen 2,3—7,5 μ breit.

Konidien dunkel ockerbraun, undurchsichtig, starr, schwach oder stark gekrümmt, nach oben und unten verschmälert, oben abgerundet, unten gleichmässig in einen kurzen Stiel übergehend, aus mehr oder weniger regelmässigen kubischen Zellen zusammengesetzt, an den Querwänden schwach eingeschnürt, etwa 15 bis 18-zellig, aussen von kleinen, abgerundeten, dicht stehenden, etwa 1 μ breiten Warzen rauh, 100—150 (—200) × 7,5—9,5 μ.

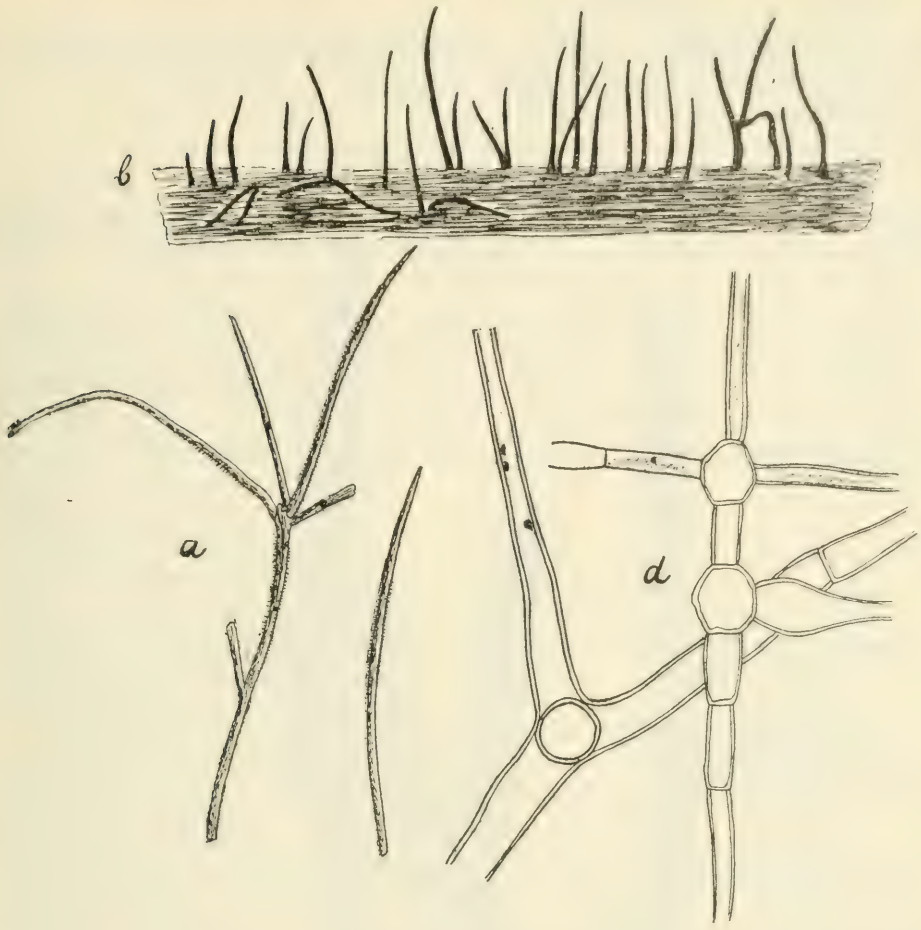


Abbildung 5: a, b, d.

Stiel 1-3-zellig, glattwandig, in der Mitte stark verschmälert, 15—30 μ lang. Bisweilen entstehen die Konidien als Seitenzweige aus konidienähnlichen Bildungen, welche glattwandig und etwas heller gefärbt und viel länger und breiter (bis 16 μ) als die Konidien sind.

Von *Orchideen* wurde bis jetzt keine *Clasterosporium*-Art beschrieben.

Clasterosporium Glomerae v. OVEREEM nov. spec.

Mycelio pallide brunneo, septato, typice rectangulariter ramoso; hyphae 2,3—7,5 μ latae.

Conidia obscure ochraceo-brunnea, opaca, rigida, magis minusve curvata utrinque attenuata, 14—18 septata, loculis cubiformibus, ad septa leniter constricta, apice rotundata, deorsum in stipitem brevem attenuata, verrucosa 100—150 (-200) $\times$ 7,5—9,5 μ.

Verrucae minimae, 1 μ latae, hemiglobosae.

Pedicellum breve, 1—3 loculatum, glabrum, 15—30 μ longum, medio attenuatum.

In foliis et ramis vivis *Glomerae subuliformis* J. J. SMITH, (leg. VON RÖMER) et *Glomerae uniflorae* J. J. SMITH (leg. G. VERSTEEG) Nova Guinea hollandiae.

Erklärung zu Abbildung 5:

a. Zweig mit Blättern von *Glomera subuliformis* J. J. SMITH, vom Pilz befallen.
b. Zweigstück mit dem Pilz, stark vergrössert.
c. Konidien, 850/1.
d. Myzel, 850/1.

Abbildung 5: c.

9. Ueber Spegazzinia ornata SACC.

Die Gattung *Spegazzinia* mit der Grundart *Sp. ornata* wurde im Jahre 1880 von SACCARDO begründet und bildet eine der schlimmsten Mystificationen. Später sind dann einige andere Arten zu dieser Gattung gebracht worden, ohne dass sie mit dem Typus genügend übereinstimmen.

Sp. ornata scheint mir eine seltene Art. In der Literatur habe ich nichts Näheres über ihre Verbreitung finden können. Vielleicht ist sie in tropischen Gegenden mehr verbreitet, denn oft habe ich ihre typischen Konidien in meinen Präparaten vereinzelt gefunden. Schliesslich entdeckte ich sie auf einer alten *Areca*-Blattscheide, welche in der Nähe von Buitenzorg gefunden worden war. [1])

[1]) Die Art wurde auch von PROF. Dr. O. PENZIG in Buitenzorg auf faulendem Holz gefunden, aber in der Literatur wird nur der Namen erwähnt (PENZIG, O. et SACCARDO, P. A., Diagnoses fungorum novorum in insula Java collectorum, Ser. III, Malpighia Vol. XV 1901, p. 260).

Ihre typischen Konidien schliessen jede Verwechselung aus und auch die Dimensionen stimmen gut. Die Entstehung der Konidien nach SACCARDO aber ist Fantasie (seine eigenen Figuren wiedersprechen der Beschreibung davon!); also ist die Gattungs-und Grundartdiagnose falsch. Nach SACCARDO entstehen die glattwandigen kreuzförmigen Konidien auf den Sterigmen (= Stacheln) von vierzelligen langgestielten Trägern. Diese Stacheln stehen aber so dicht, dass für die etwa die gleichen Dimensionen als die Träger besitzenden Konidien kein Platz überbleibt. Das ist sofort aus der beigefügten Figur zu sehen, während auch die Angabe von der Länge der Sterigmen (30 μ) falsch sein muss, im Verhältnis zur Stielbreite können sie höchstens 8 μ lang sein. Folgt man der Gattungsdiagnose von SACCARDO, so könnten die übrigen Arten unmöglich in dieser Gattung verbleiben, weil ihre Konidien nicht auf Trägern, sondern direkt auf dem Basalgewebe entstehen. Weil dies nun tatsächlich auch bei der Saccardo'schen Art der Fall ist, hat man die Gattungsdiagnose zu ändern.

Spegazzinia SACC. emend. VAN OVEREEM.
Sporodochia convexa; densiuscula, atra.
Stroma basale rotundum, planum, brunneum.
Conidia sarciniformia, glabra vel aculeata, brunnea, dense fasciculata, radiata, longitudine stipitis valde variabilia.

Im folgenden gebe ich von der Grundart eine Neubeschreibung.

Sporodochien bis 1 mm i. D. schwarz oder braunschwarz, rund oder mehr unregelmässig gestaltet, bisweilen zusammenfliessend, polsterförmig, ziemlich derb.

Basalstroma abgeplattet, rund, aus verflochtenen, braunwandigen, septierten Hyphen zusammengesetzt.

Konidien ausserordentlich variabel, immer gestielt, aber auch die Stiellänge sehr wechselnd, bei reifen Konidien von 22 bis 130 μ. Die Stiele entspringen dem Basalstroma, sind zuerst kurz papillenförmig und farblos; dann schwillt das obere Ende an und bildet eine farblose Zelle, in welcher eine Querwand gebildet wird. Jetzt wird die Zelle mehr oder weniger scheibenförmig, es entstehen die Längswände, wodurch die Konidie vierzellig wird. Von diesem Stadium ab ist die Entwicklung verschieden. Entweder vergrössert sich die Konidie, färbt sich braun und bleibt glatt, oder die Zellen runden sich stark ab und bilden an ihrer Oberfläche verschieden lange Stacheln, oder es entstehen zuerst mehrere radiäre Wände und die Konidie wird scheibenförmig und schön regelmässig achtzellig. In allen Fallen schnüren die Konidien sich bei den Querwänden etwas ein und so entstehen kreuzförmige Gebilde. Die Braunfärbung tritt erst ein, wenn das Bauprinzip der jungen Konidie fertig ist. Während der weiteren Entwicklung wächst die Anhaftungspapille stielförmig zu sehr verschiedener Länge aus und färbt sich braun. Ihr Durchmesser ist 2—3 μ, ihre Wand ist glatt, aber bisweilen von unregelmässigen, braunen Stücken rauh.

Also gibt es schliesslich drei Arten von Konidien, zwischen welchen alle Übergänge existieren.

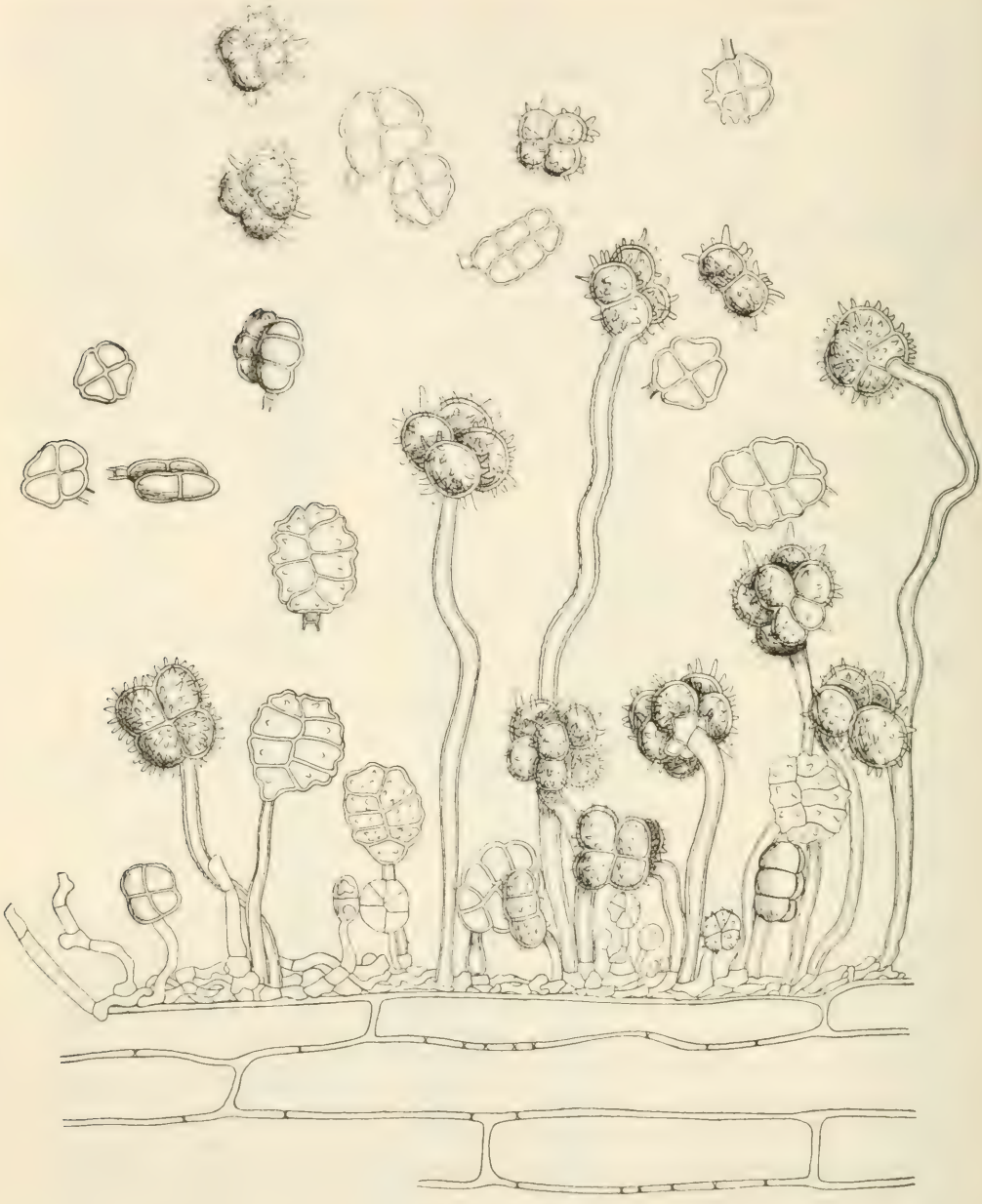


Abbildung 6.

1. Regelmässig kreuzförmig, vierzellig, bei den Querwänden etwas eingeschnürt, braun, glatt, bisweilen aber hier und da mit sehr kurzen Stacheln (Übergangsform nach 3), immer sehr kurz gestielt. An den abgefallenen Konidien ist die breite (!) farblose Anhaftungsstelle oft deutlich zu sehen (!), 11—17 μ i. D.
2. Achtzellig, scheibenförmig, schön paketförmig geordnet, bisweilen sechszellig (Übergang nach 1) auch meistens kurz gestielt, braun, glatt oder jede Zelle mit 1 oder 2 Reihen sehr kurzer Stacheln, Aussenwand

jeder Zelle in der Mitte mehr oder weniger tief ausgebuchtet, bei den Querwänden eingeschnürt, etwa 18×24 μ.

3. Bauprinzip wie 1, aber die Zellen aufgeblasen kugelförmig, dicht mit sehr verschieden langen Stacheln bedeckt, braun, ohne Stacheln 11—17 μ i. D.; mit langen, buchtigen glatten oder rauhen, braunen Stielen. Oft sind diese Pakete doppelt, also zwei mal 4 Zellen ober einander, oder ganz unregelmässig geordnet. Die Stacheln sind bis 6 μ lang, braun oder fast farblos.

Erklärung zu Abbildung 6:
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CONTRIBUTIONS A L' ÉTUDE DE LA FLORE DES INDES NÉERLANDAISES.

Sous ce titre général seront publiées des études de familles végétales ayant des représentants aux Indes Néerlandaises. Le moment n'est guère favorable, il est vrai, pour commencer la publication d'une Flore de l'Archipel Malais; aussi ces études devront autant que possible se limiter au strict nécessaire et ne comporter que les indications directement indispensables pour qu'elles puissent être utilisées avec fruit.

Elle comprendront des descriptions (avec figures explicatives) des espèces nouvelles ou insuffisamment connues, si toutefois le matériel d'étude est suffisant; elles comprendront ensuite des compléments aux descriptions déjà existantes, des notes et des explications chaque fois que cela sera jugé nécessaire; puis des tabelles de détermination et des indications concernant la bibliographie et les stations où les plantes ont été récoltées.

Par contre, quand s'agira d'espèces bien décrites on se contentera de renvoyer aux ouvrages déjà existants, et on évitera, pour les espèces très ubiquistes de donner de longues listes de localités; enfin les noms indigènes si souvent douteux et contradictoires se limiteront au minimum indispensable.

Les familles se succéderont dans un ordere parfaitement arbitraire et paraîtront au fur et à mesure, dès que leur étude sera achevée. Cependant pour répondre à des besoins de nature purement pratique, on entreprendra en premier lieu les familles qui ont quelque importance économique.

J. J. SMITH.

DIE LOGANIACEEN UND BUDDLEIACEEN NIEDERLÄNDISCH-INDIENS.

von

Dr. HERMANN CAMMERLOHER (Buitenzorg).

Die vorliegende Bearbeitung wurde auf Grund des im Buitenzorger Herbars vorhandenen *Loganiaceen*- und *Buddleiaceen*-Materials gemacht und will einen Überblick über die bisher aus Niederländisch-Indien bekannt gewordenen Vertreter dieser Familien geben. Durch die aufgestellten Gattungs- und Art-Bestimmungsschlüssel soll die Bestimmung der Arten ermöglicht werden.

Die Synonyma wurden nicht neuerlich aus der Literatur übernommen, sondern es wurde bei jeder Art die Literatur angegeben, in der die Originaldiagnose enthalten ist und womöglich die letzte, in der die betreffende

Art eingehend behandelt wurde und aus der die Synonyma zu ersehen sind. Decken sich diese nicht mit meiner Ansicht oder sind neue hinzuzufügen, so wurde dies vermerkt.

Das am Schlusse aufgestellte Literaturverzeichnis enthält die verwendeten allgemeinen, zusamenfassenden Werke und wichtigere Einzelarbeiten aus den beiden Familien.

Die beigegebenen Textabbildungen wurden von dem inländischen Zeichner DARMOSOEDIRO angefertigt.

LOGANIACEAE.

Bestimmungsschlüssel der Gattungen.

1a	Frucht eine Kapsel.	2
1b	Frucht eine Beere oder Steinfrucht	7
2a	Kronlappen in der Knospenlage gedreht oder dachig.	3
2b	Kronlappen in der Knospenlage klappig	4
3a	Griffel an der Spitze doppelt zweiteilig; Fruchtknotenfächer mit zahlreichen Samen. . . . . I. *Gelsemium.*	
3b	Griffel einfach, Samen in einer Pulpa eingebettet II. *Geniostoma.*	
4a	Aussenkelch vorhanden, wenn auch wenig entwickelt VI. *Norrisia.*	
4b	Aussenkelch fehlend	5
5a	Kapsel mit kupulaartigem Basalteil . . . . . III. *Spigelia.*	
5b	Kapsel ohne kupulaartigem Basalteil; Griffel an der Basis mehr oder weniger deutlich zweischenklich oder zwei freie Griffel . . .	6
6a	Fruchtknoten halbunterständig, Blüten 5zählig . . IV. *Mitreola.*	
6b	Fruchtknoten oberständig, Blüten 4zählig . . . V. *Mitrasacme.*	
7a	Kronlappen in der Knospenlage klappig	8
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9a	Blätter 3—5nervig . . . . . VII. *Strychnos.*	
9b	Blätter fiedernervig	10
10a	Antheren zusammenhängend, einfächerig . . . VIII. *Gardneria.*	
10b	Antheren frei, zweifächerig . . . . . IX. *Pseudogardneria.*	
11a	Blumenkrone trichterförmig, ohne Schuppen im Schlund . . . . . X. *Couthovia.*	
11b	Blumenkrone trompetenförming, mit Schuppen im Schlund. . . . . XI. *Crateriphytum.*	

I. GELSEMIUM JUSS.

Gen. 150; E. & P. IV/2, 28. [1])

Gelsemium elegans BENTH. in Journ. Linn. Soc. I, 453; MIQ. Fl. Ned. Ind. II, 359.

[1]) E. & P. = ENGLER und PRANTL; Die natürlichen Pflanzenfamilien.

Sumatra: Midd. Habinsaran bei Parsoboeran (LÖRZING no. 7859, Sh. ± 1070 m), Notiz auf dieser Etikette: „elders nog op één plaats nabij Nassan (O. v. Parsoboeran) gezien."

Nach MIQUEL a.a.O. auf Sumatra (PRAETORIUS) gefunden.

II. GENIOSTOMA FORST.

Char. gen. t. 12; SOLEREDER in E. & P. IV/2, 31; VALETON in Bull. Inst. bot. Buitenzorg XII, (1902).

Schlüssel zur Bestimmung der Arten.

1a Konnektiv mit einem deutlichen Fortsatz an der Spitze 2
1b Konnektiv am Gipfel stumpf oder mit sehr kurzem Fortsatz . . . 4
2a Konnektivfortsatz klein 3
2b Konnektivfortsatz so lang oder mehr als halb so lang als die Anthere . . . . . 3. *G. Miquelianum* K. & P.
3a Antheren und Filamente behaart, Blätter lanzettförmig . . . . . 1. *G. arboreum* O. K.
3b Antheren und Filamente unbehaart, Blätter elliptisch, Blattrand oft gewellt. . . . . 2. *G. acutifolium* HIERN.
4a Antheren 1,4 mm lang, Narben fast sitzend, Blätter gross, länglich-eiförmig. . . . . 5. *G. moluccanum* VAL.
4b Antheren 0,84 mm lang, Griffel vorhanden 5
5a Blätter länglich, in eine schlanke Spitze ausgehend, Schlund und Blumenkronröhre innen behaart . 6. *G. oblongifolium* K. & V.
5b Blätter elliptisch oder lanzettlich, Schlund und Blumenkronröhre innen nackt. . . . . 7. *G. celebicum* VAL.

1. Geniostoma arboreum O. K. Rev. gen. plant. (1891), 425; *G. haemospermum* STEUD. Nomencl. (1840). 669; VALETON in Bull. Inst. bot. Buitenzorg XII, 1902, 21; KOORDERS & VALETON Bijdr. 9, 1903, 56; *Haemospermum arboreum* BL. Bijdr. 1826.

Das Hauptverbreitungsgebiet ist West-Java.

Java: Res. Bantam: G. Poelasan (KOORDERS no. 6177 β, Sh. 1375 m); Res. Batavia: Nirmala (BACKER no. 10759, Sh. 1200 m); Salak, G. Gadjah (BAKHUIZEN V. D. BRINK no. 4155, Sh. 2200 m); Res. Preanger: Gede, Tjibodas, Tjibeureum, Sh. 1500—2000 m (HALLIER n. 420, BOERLAGE, VALETON, BURK, BACKER n. 13549, 22271, KOORDERS n. 12667β, 31932β, 31950β, 32013β, 31710β, SAPIN); Ostabhang Sh. 1440—1750 m (BACKER n. 3257, 3207); Südabhang Sh. 1600 -2000 m (BACKER n. 3361, 14662); ober Salabintana (BAKHUIZEN V. D. BRINK n. 2785); ober Kandang Badak, Sattel Gede-Pangerango, Sh. 2450—2600 m (BACKER n. 31289, 31373, KOORDERS n. 15617β); Gegerbintang Sh. 1500 m (DEN BERGER n. 593); Passir Datar, Fuss des Pangerango, Haltestelle Tjisaat (BAKHUIZEN V. D. BRINK n. 2099, Sh. 1000 m); Pangerango (KUHL und V. HASSELT n. . . ., KOORDERS n. 15634β, Sh. 1800 m, 31776β, Sh. 2600 m, 25854β); Bandoeng, G. Ocroeg (SMITH und RANT n. 362, Sh. 2000 m); Weg Kendeng-Rioeng

Goenoeng Sh. 1700 m, (SMITH und RANT n. 250, 409); Goenoeng Patoeha, Nordabhang, Sh. 1600 m (LÖRZING n. 1388); Garoet (BURCK); Goenoeng Telaga Bodas ober Pangentjongan, Sh. 1400 m (BACKER n. 31888, KOORDERS n. 14098 β); G. Goentoer (KERKHOVEN n. 16, BAKHUIZEN V. D. BRINK n. 107 Sh. 1200 m); Südabhang Sh. $\pm$ 2200 m (KOENS n. 122); ober Tjipanas, Sh. 1200 m (BACKER n. 5214); G. Galoenggoeng Sh. 1800 m (KOORDERS n. 4663 β).

Sumatra: Palawan (BÜNNEMEIJER no. 9556, Sh. 1900 m).

2. **Geniostoma acutifolium** HIERN. in Nova Guinea VIII, (1909), 201.

Neu Guinea: Noord River bei Alkmaar (VERSTEEG no. 1513).

3. **Geniostoma Miquelianum** K. & V. in Bull. Inst. bot. Buitenzorg XII, (1902), 22.

Das Hauptverbreitungsgebiet ist Mittel- und Ostjava. Nach BACKER sind die Blüten grünweiss und stinkend, während LÖRZING die Blüten als wohlriechend bezeichnet.

Java: Res. Banjoemas: G. Slamet sw. von dem Schuttkegel, Sh. 2450 m (BACKER no. 449); G. Prahoe, Sh. 2500 m (BACKER no. 21826); Res. Besoeki: Ijang-Gebirge, Nordostseite, Sh. 1650 m (BACKER no. 9595); Res. Kediri: Wilis—Komplex, Ostseite, G. Wanasegara Sh. 1500 m (BACKER no. 11551); Res. Kedoe: G. Soembing, N. O. Seite, Sh. $\pm$ 1800 m (LÖRZING no. 132); G. Prahoe, Dieng-Plateau (KOORDERS no. 11233 β, 11234 β, 11235 β, Sh. 255 m); G. Kembong, Sh. 1700 m, (KOORDERS no. 10917 β); G. Sindoro bei Parakan, Sh. 2200 m (KOORDERS no. 11339 β, KOORDERS no. 11340 β, Sh. 1405 m); G. Andong (KOORDERS no. 36612 β, Sh. 1200 m); Res. Madioen: Poedak, Sh. 2000 m (KOORDERS no. 6178 β); Res. Pasoeroean: Tengger oberhalb Lawang, Sh. über 1400 m (MOUSSET no. 281); G. Tengger, W. Abhang bei Kledak, Sh. 1200—1800 m (MOUSSET no. 147, 1045); Tengger, Nordabhang oberhalb desa Ngepoeh (v. Harreveld no. 46, Sh. 1600 m); (DOCTERS V. LEEUWEN-REIJNVAAN no. 4487, 4538); G. Tengger, zwischen Nongkodjadjar und Ngadiwono, Sh. 1500 m (BREMEKAMP); G. Ardjoeno, Sh. 1400—2400 m (BREMEKAMP, KOORDERS no. 38141 β); G. Smeroe Südwestabhang, Sh. 1200—2000 m (BACKER no. 3618, no. 3739); (ZOLLINGER no. 23); G. Kembang Sh. 2000 m (KOORDERS no. 37661 β & 37662 β); Res. Pekalongan: Petoeng, Kriana Sh. 1600 m, (BACKER no. 15819); G. Sari-Slamat, Sh. 1500 m (KOORDERS no. 4665 β); Res. Semarang: G. Telomoja, Sh. $\pm$ 1400—1500 m (DOCTERS V. LEEUWEN-REIJNVAAN, no. 1094, 2212, 164; KOORDERS no. 4655 β, 27908 β, 35880 β, 35879 β).

Sumatra: Midd. Habinsaran bei Sibosor (LÖRZING no. 7729, Sh. $\pm$ 1250 m).

4. **Geniostoma lasiostemon** BL. Mus. bot. Lugd Bat. I. 239.

Mir liegt von diesser Art kein Exemplar vor; sie soll nach BLUME in Neu Guinea heimisch sein.

5. **Geniostoma moluccanum** VAL. in Bull. Inst. botan. Buitenzorg XII. Die Blüten duften angenehm, honigartig, die Farbe der Blütenblätter ist hellgrün mit weissem Rand, Filamente und Antheren elfenbeinweiss, Narbe sehr hellgrün.

Molucken: Ambon (ROBINSON no. 2034); (KORNASI no. 1140, Sh. 300—400 m).

Kultiviert im botan. Garten zu Buitenzorg: X G 22.

6. Geniostoma oblongifolium K. & V. in Bull. Inst. bot. Buitenzorg XII, (1902), 20.

Java: Res. Besoeki: Pantjoer, Idjen (KOORDERS no. 28644 β, 14872 β, 34001 β, 14654 β, 32397 β); Res. Preanger: Pasir Datar, Abhang des Pangeranggo bei Tjisaat Sh. 1000 m (BAKHUIZEN V. D. BRINK no. 2099).

7. Geniostoma celebicum VAL. in Bull. Inst. bot. Buitenzorg XII, 19.

Celebes: Minahasa, Lolomboelan bei Poekoe-oere, Sh. 600 m (KOORDERS no. 18713 β); Pinamarongon-Gebirge, Sh. 500 m (KOORDERS no. 18721 β); Jungwald bei Kojoe-watoe, Sh. 50 m (KOORDERS no. 18722 β); Weg von Tondono nach Ajermedidi. (KOORDERS no. 18724 β); bei Ratahan, Sh. 317 m (KOORDERS no. 24063 β); Lokka—Bonthain (TEYSMANN no. 14000 & 14021).

Kultiviert im botan. Garten zu Buitenzorg: X G 24.

Nach KOORDERS sind die reifen Früchte schwarz, die Samen schön rot.

8. Geniostoma avene VAL. in Bull. Inst. bot. Buitenzorg XII, 23.

Diese Art ist nur unvollständig bekannt.

Poeloe Gebeh /Insel zwischen Celebes und Neu Guinea/(TEYSMANN no. 7578).

III. SPIGELIA L.

Gen. ed I. 361; Solereder in E. & P. IV/2, 32.

Im Gebiet kommt eine hier nicht heimische, aus Amerika eingeschleppte Art vor.

Spigelia anthelmia L. Sp. Pl. 149; PROGEL in Flora bras. IV/1, (1868), 262.

Java: Res. Banjoemas: Tjilatjap, Sh. 5 m (BACKER no. 21007, 4594); Res. Bantam: Poeloe Babi (BOERLAGE); Res. Batavia: Mangga besar, Batavia, Sh 5 m (BACKER no. 3245); Doeren bei Batavia, Sh. 30 m (BACKER no. 32457; 32456); Buitenzorg, Sh. 235 m (HALLIER no. 201a; LÖRZING no. 1528; BACKER no. 32454; KOORDERS no. 44155); Land Tjiomas bei Buitenzorg Sh. 250 m (BACKER no. 26328); Masèng, Sh. 425 m (BACKER no. 9420); Res. Djokjakarta: zwischen Djokjakarta und Pioengan, Sh. 100—150 (BACKER no. 2552); Res. Kedoe: Gombong (VON HARDENBERG); Res. Preanger: Pelaboean Ratoe, Sh. 1 m (BACKER no. 2283); Poeloe Mas besar bei Java/eine unauffindbare Ortsangabe/(VALETON).

Kultiviert im botan. Garten zu Buitenzorg: XV K A XXXIII 9.

IV. MITREOLA L.

Gen. ed I, 377 (1737). SOLEREDER in E. & P. IV/2, 34.

Mitreola paniculata WALL. Cat. 4349; KOORDERS, Flora von Java III, (1912), 57.— *M. Oldenlandioides* WALL. Cat. 4350; DOP in Bull. Soc. bot. France 57, (1910) Mem. 19, 3.

Bali: G. Saraja (ZOLLINGER & MORITZI no. 376, 21. Mai 1845).

In ZOLLINGER System. Verz. wird unter no. 376 als Fundort Tjikojam (auf Java) angegeben, allerdings mit dem Datum 29. Juni 1845, während die Etikette im Herbar das obenerwähnte Datum und jenen Fundort trägt.

Java: Res. Bantam: Bodjangmanik (KOORDERS no. 40779 ?); Res. Djokjakarta: zwischen Wanosari und Djokjakarta, Sh. 150—200 m (BACKER no. 2504) Res. Kediri: Komplex Poengloer, Nordabhang G. Wilis, Sh. 125 m (WIND no. 2565); Res. Madioen: Saradan Sh. ± 30 m (WISSE no. 159); Komplex Saradan Sh. 110 m (BEUMÉE no. 2230); zwischen Patjitan und Toelahan, Sh. 320 m (BACKER no. 2043); zwischen Toelahan und Tegalombo, Sh. bis 430 m (BACKER no. 2943); Res. Pasoeroean: Bangil, Sh. 15 m (BACKER no. 7567); Kepoeh bei Pasoeroean Sh. 50—75 m (BACKER no. 20966, 8323); Wangkal südl. von Kraksaän Sh. 100 m (BACKER no. 13039); Res. Pekalongan: Försterei Margasari, Sh. ± 100 m (BEUMÉE no. 5165); Res. Preanger: Radjamandjala Sh. 300 m (BACKER no. 13185); längs der grossen Poststrasse östl. von Tjisokan (TEYSMANN no. 18334); Tomo Sh. 70—100 m (BEUMÉE no. 4748); Res. Rembang: Försterei Balo Sh. ± 100 m (BEUMÉE no. 5526); Försterei Bekoetoek südl. von Blora, Sh. 60 m (BLOKHUIS); Försterei Nanas, Sh. ± 100 (BEUMÉE no. 858); Försterei Ngawen, Sh. ± 100 m (BEUMÉE no. 791); Padangan, Komplex Wadeng Sh. + 100 m (BEUMÉE no. 1003); Försterei Pajaman Sh. ± 100 m (BEUMÉE no. 886); Res. Semarang: Försterei Tempoeran, Sh. 125 m, (BEUMÉE no. 5107); Regaloh bei Pati, Sh. 75 m (BEUMÉE no. 3937); Res. Soerabaja: Komplex Medowo, Sh. 50—100 m (BEUMÉE no. 2658); Koepang bei Soerabaja, Sh. 30 m (BREMEKAMP); Nord-Soerabaja Sh. ± 100 m, (WEEDA no 2270 & 2271); Res. Madoera: Rapa bei Sampang Sh. 100 m (BACKER no. 20122).

Kangean—Archipel: P. Sepandjang Sh. 1-5 m (BACKER no. 28752, 28797); P. Saoebi, Sh. 5 m (BACKER no. 28295); G. Saseel, Sh. 1 m (BACKER no. 28631); P. Bangko, Sh. 2 m (BACKER no. 29237); P. Saboenten Sh. 5 m (BACKER no. 28461); P. Paliat, Sh. 5-25 m (BACKER no. 29400); P. Kangean, Tambajangan, Sh. 130 m (BACKER no. 27423); P. Kangean, Tjangkramaan, Sh. 5 m (BACKER no. 27933); P. Kangean, zwischen Tambajangan und Batoepoetih, Sh. 100 - 130 m (BACKER no. 27614); P. Kangean, Gelaman, Sh. 30 m (BACKER no. 27127); P. Kangean, Kajoe Waroe, Sh. 50 m (BACKER no. 28124); P. Kangean, Ardjasa, Sh. 30 m (BACKER no. 26882).

Neu Guinea: Merauke (Exp. KOCH 1904—1905, no. 341 ?); Mamberano—Fluss, Pionierbiwak, Sh. 70 m (LAM no. 508); Kaiser—Wilhelmsland, Stephansort (LEWANDOWSKY no. 47); Mündung des Markhamflusses (Weinland no. 209).

Kultiviert im botan. Garten zu Buitenzorg: XV K A XXXIII 5.

var. lilacina BACKER nov. var.

Herba humilis floribus lilacinis, lobis fructus divergentibus, rectis.

Die Varietät ist kleiner als die typische Form, oft ein ganz niedriges Pflänzchen. Die Form ist selten und kommt auf feuchten Terraswänden vor.

Java: Res. Madioen: zwischen Tegalombo und Slahoeng, Sh. 300 m (BACKER no. 3400); zwischen Toelahan und Tegalombo, Sh. 500 (BACKER

no. 2942); Res. Besoeki: Nordabhang des G. Idjen, oberhalb Bajeman Sh. 500 m (BACKER no. 3070).

v. MITRASACME LABILL.

Nov. Holl Pl. I, 25; BENTHAM Fl. Austral. IV, (1869), 349; SOLEREDER in E. & P. IV/2, 35.

Schlüssel zur Bestimmung der Arten.

1a Stengel beblättert 2
1b Stengel nicht beblättert, Blätter eine grundständige Rosette bildend. 4
2a Stengel bis oben beblättert; Blüten in den Achseln der Blätter. . 3
2b Stengel nur im unteren Teil beblättert; blütentragende Stengel blattlos, nur kleine Schuppen tragend . 1. *M. pygmaea* R. BR.
3a Kelch bis zur Mitte geteilt; zierliche Pflänzchen 2 *M. alsinoides* R BR.
3b Kelch verwachsen, am oberen Rand vier Zähnchen tragend; kleine, aber derbe Pflanze, reich beblättert 3. *M. saxatilis* BACKER n. sp.
4a Grosse, aufrechte Pflanze; Blüten gross, Griffel lang, an der Frucht nur an der Basis in zwei Hälften auseinanderweichend; Frucht länglich-eiförmig . . . . . 4. *M. elata* R. BR.
4b Zarte Pflanze mit fadenförmigem Stengel, Blüten sehr klein, Griffel an der Frucht bis zur Spitze auseinanderweichend, schliesslich ganz getrennt; Frucht klein, kugelig. 5. *M. nudicaulis* REINW.

1. **Mitrasacme pygmaea** R. BR. Prod. 453; BENTHAM Fl. Austral. IV, 357.

Molucken: Insel Taliaboe, Kap Kapo (HULSTIJN no. 87).

Timor: (FORBES no. 3884).

2. **Mitrasacme alsinoides** R. BR. Prod. 453; BENTHAM Fl. Austral. IV, 353; DOP in Bull. Soc. bot. France 57, (1910), Mém. 19, 4.

Java. Res. Bantam: Gebiet östl. Pasoeroean, Sh. 100 m (BACKER no. 7207); Res. Batavia: Hügelgegend südl. von Kalapa Noenggal Sh. 100—150 m (BACKER no. 5799); Tji Hanjawar westl. von Buitenzorg Sh. 300—400 m (BACKER no. 6218); Res. Preanger: Tji Mapag, nördl. von Kiara Pajoeng Sh. 300 m (BACKER no. 23870); Res. Madoera: Bangkalan Sh. 40 m (BACKER no. 19131); Gebiet nördl. von Pragaan, 24 km östl. von Madoera Sh. 100 m (BACKER no. 20434); Hügelgegend östl. von Ketapang daja Sh. 10—50 m (BACKER no. 19840); Rapa, ungefähr 6 km nö. von Sampang Sh. 100—150 m (BACKER no. 19764); zwischen Rapa und Moktisari Sh. 100 m (BACKER no. 20139); zwischen Rapa und Pamekasan Sh. 40 m (BACKER no. 20233); Hügelgegend östl. von Tamberoe Sh. 25 m (BACKER no. 20579); Arosbaja Sh. 25 m (BACKER no. 19307); Hügelgegend nördl. von Soemenep, Sh. 50 m (BACKER no. 20684); Res. Soerabaja: Hügel n. von Karangbinangoen, Sh. ± 100 m (DORGELO).

Kangean—Archipel: Insel Kangean, Ardjasa Sh. 30 m (BACKER no. 27032); Tambajangan Sh. 25—130 m (BACKER no. 27722, 27485) zwischen Ardjasa und Pabean Sh. 15 m (BACKER no. 27195).

3. Mitrasacme saxatilis BACKER nov. spec. Abb. 1, Fig. 1—3.

Herba perennis, erecta, circa 8 cm alta, ramosa; caulis et ramulis foliosis. Folia opposita, non petiolata, lato-ovata, apice acuta, basi lata, rotundata, in sicco margine revoluto; flores singuli in axilis foliorum, calice 4dentato, 1½—2 mm longo; corolla mihi ignota. Capsula ellipsoidea, e calice parum exserta.

Diese Art ist durch ihre reichbeblätterten Stämmchen ausgezeichnet. Die Blätter sind sitzend und endigen in eine Stachelspitze, die an Herbarexemplaren meist zurückgebogen ist. Die Frucht ragt nur wenig mit dem oberen Teil, den zusammenneigenden Griffelhälften, aus dem Kelch. Die Blumenkrone soll nach BACKER weiss sein.

Java: Res. Madoera: Hügelgebiet nördl. von Soemenep, Sh. 50—75 m (BACKER no. 21265); Res. Soerabaja: Hügel nw. von Banjoewangi und n. von Karangbinangen, Sh. ± 100 m, auf trockenem Kalkgrund zahlreich, (DORGELO).

Abb. 1 Fig. 1—3 Mitrasacme saxatilis. Fig. 1 Habitus, Fig. 2 Frucht; Fig. 3 Frucht, Kelchblätter zurückgeschlagen. [1])

4. Mitrasacme elata R. BR. Prodr. 453; BENTH. Fl. Austral. IV, 354.

Neu Guinea: Süd-Neu Guinea bei Okaba (BRANDERHORST no. 86, 90); bei Merauke (VERSTEEG no. 1932); Südhang des Dikatales, nördlichster Nebenfluss des Swartflusses Sh. 1250 m (LAM. no. 2077).

5. Mitrasacme nudicaulis REINW. in BLUME Bijdr. 849; BENTHAM Fl. Austral. IV, 354; DOP in Bull. Soc. bot. France 57, (1910), Mém 19,4.

Die Blüten sind nach LÖRZING weiss, oft mit Purpurflecken.

Sumatra: Karohochebene bei Raja Sh ± 1250 m (LÖRZING no. 4901); Karohochebene bei Brastagi, 1350 m (LÖRZING no. 6167, 8412); Nordwestrand des Tobasees an den Piso-Piso Sh. ± 1350 m (LÖRZING); zwischen Siboeatan und den Piso-Piso, nw. vom Tobasee Sh. ± 1400 m (LÖRZING no. 7202); Habinsaran-Hochebene oso. vom Tobasee Sh. 1200—1300 m (LÖRZING no. 6475); Midd. Habinsaran bei Parsoboeran, Sh. ± 1070 m (LÖRZING no. 7895).

Timor: (FORBES no. 3492).

[1]) Der Kelch wurde beim Zurückschlagen zerrissen, daher die Kelchblätter scheinbar nicht verwachsen.

Mitrasacme polymorpha R. BR. Prodr. 452; BENTHAM Fl. Austral. IV, 353; DOP in Bul. Soc. bot. France 57 (1910), Mém. 19,5.

Nach CLARKE in Hooker Fl. Brit. Ind. IV, 80 und KING und GAMBLE in Jour. As. Soc. Beng 74/2, (1908), 600 soll diese Art auch im malayischen Archipel vorkommen, ohne dass aber genauere Standortsangaben gemacht wären. Mir liegt kein Material aus dem Gebiete vor.

VI. NORRISIA GARDN.

In HOOK. Kew Journ. I, 326; SOLEREDER in E. & P. IV/2,37.

Norrisia malaccensis GARDN. in HOOK. Kew Journ. I, 327; MIQUEL Fl. Ned. Ind. II, 359; KING & GAMBLE in Journ. As. Soc. Beng. Vol. 74/2,602.

Riouw-Archipel: Insel Senggarang (TEYSMANN).

Sumatra: Res. Palembang: Banjoeasin & Koeboestreken (ENDERT no. 146 E 1P 838; GRASHOFF no. 944, Sh. ± 20m).

Nach CLARKE in HOOK. Fl. Brit. Ind. IV, 85 auch von Borneo bekannt.

Der Stamm ist selten aufrecht, 25 bis 28 m hoch, bis 70 cm im Durchmesser, mit bis 4 m weit hinauflaufenden, dicken aber nicht breiten Bretterwurzeln; die Krone ist hoch angesetzt und sehr breit. Die Rinde ist rotbraun, nicht abschilfernd. Die Blüten sind weiss und sehr wohlriechend. (Nach GRASHOFF).

VII. STRYCHNOS L.

Gen. n. 253; SOLEREDER in E. & P. IV/2, 37; KOORDERS & VALETON Boomsoorten op Java Bijdr. IX, (1903), 64; HILL A. W. The Genus Strychnos in India and the East in Kew Bull. 1917, 121—210.

Da mir nur unvollständiges und vielfach schlecht erhaltenes Material vorlag, so musste ich mich vielfach auf Angaben aus der Literatur beschränken Ein grosser Teil konnte überhaupt nicht bestimmt werden, da das Material grösstenteils ohne Blüten war, die bei der Bestimmung der *Strychnos*—Arten vor allem in Betracht kommen, andrerseits, da mir, allein auf das Buitenzorger Herbar beschränkt, Originalmaterial zum Vergleiche fehlte. Aus diesen Gründen muss ich auch von der Aufstellung eines Bestimmungsschlüssels absehen. Sollte mir besseres Material in Zukunft zugänglich werden, so soll diese Gattung einer neuerlichen und eingehenden Bearbeitung unterzogen werden.

1. **Strychnos villosa** HILL in Kew Bull. 1911, 296 und Kew Bull. 1917 143.

Nach HILL auf Java: „Wukau" (HORSFIELD no. 1319); ohne nähere Standortsangabe (KURZ).

Mir liegt von dieser Art kein Material vor.

2. **Strychnos lanceolaris** MIQ. Fl. Ind. Bat. Suppl. 227, 551; HILL in Kew Bull. 1911, 296 und Kew Bull. 1917, 144.

Nach HILL auf Sumatra: (KORTHALS); Palembang bei Moeara Enim (TEYSMANN).

Diese Pflanze fehlt im Buitenzorger Herbar.

3. Strychnos septemnervis CLARKE in HOOK. Fl. Brit. Ind IV, 88; HILL in Kew Bull. 1917, 149.

Celebes: G. Kolonodale (V. VUUREN, RACHMAD no. 652).

4. Strychnos Forbesii HILL in Kew Bull. 1909, 360; Kew Bull. 1911, 295; Kew Bull. 1917, 150.

Nach HILL in Neu Guinea: Sogeri Region (Forbes no. 216, 230).

Diese Pflanze ist im Buitenzorger Herbar nicht vorhanden.

5. Strychnos laurina WALL. Cat. 1591; HILL in Kew Bull 1917, 150.

Nach HILL auf Borneo: Bandjermasin (MOTLEY no. 902?).

Auf Java soll die Pflanze nur im botanischen Garten zu Buitenzorg vorkommen, wo sie unter X G 44 & 44a und XVI A 58 kultiviert wird.

6. Strychnos barbata HILL in Kew Bull. 1909, 359 und Kew Bull. 1917, 153.

Molucken: Ambon (Robinson no. 612).

Neu Guinea: Soron (BECCARI no. 98), nach HILL in Kew Bull. 1917, 153.

7. Strychnos polytrichantha GILG in Notizbl. d. kgl. bot. Gart. Berlin I, 1897, 267; HILL in Kew Bull. 1917, 156.

Nach GILG von Borneo: ohne nähere Standortsangabe (BECCARI no. 2275).

Im Herbar zu Buitenzorg ist diese Pflanze nicht vertreten.

8. Strychnos myriantha GILG und BENEDICT in ENGL. bot. Jahrb. 54 (1916), 167, Fig. 5.

Das mir vorliegende, unbestimmte Material stammt zum Teil von Borneo, zum Teil von der Moluckeninsel Soela; ist also für Niederländisch-Indien neu. Der Blütenbau stimmt volkommen mit der Beschreibung von *Str. myriantha* überein, ebenso zum Teil die Blätter. (Die Blätter variieren stark am vorliegenden Material). Neben den Blättern, die der Beschreibung und Zeichnung von GILG und BENEDICT gleichen, finden sich auch breit-eiförmige, ovale Blätter vor. Die Nervatur entspricht der Beschreibung.

Borneo: Boekit Liang-karing di bawah. (Exp. NIEUWENHUIS 1896—97, JAHERI no. 1253).

Molucken: Poeloe Seho (HULSTIJN); nach einer diesem Spannbogen beiliegenden Notiz sind die Blüten gelb.

Die Pflanze war bisher nur aus den Deutschen Besitzungen von Neu Guinea bekannt.

9. Strychnos pubescens CLARKE in HOOK. Fl. Brit. Ind. IV, 89; HILL Kew Bull. 1917, 166.

Borneo: Boekit Kasian (Exp. NIEUWENHUIS 1898—99, AMDJAH no. 57); nach HILL Sarawak, Mattang (BECCARI no. 2035).

Sumatra: Insel Lingga, Nordküste (TEYSMANN).

10. Strychnos Robinsonii HILL in Kew Bull. 1917, 168.

Von dieser Art ist Originalmaterial im Buitenzorger Herbar vorhanden, dem aber Blüten fehlen.

Molucken: Ambon (ROBINSON no. 2029).

11. Strychnos axillaris COLEBR. Trans. Linn. Soc. XII, 356, tab. 15; HILL in Kew Bull. 1917, 169; nach KOORDERS und VALETON Boomsoorten op Java, Bijdr. IX, 63 = *Str. monosperma* MIQ. Fl. Ned. Ind. II, 381.

Borneo: Bt. Liang Karing di bawah (Exp. NIEUWENHUIS 1896—97, JAHERI no. 1236 und 1326).

Java: Res. Batavia: Depok (HALLIER no. 389).

Kultiviert im botan. Garten zu Buitenzorg: XVI A 55.

Sumatra: Res. Sum. Westküste, NW-Abang G Talamau Sh. 1500 m (BÜNNEMEIJER no. 774).

12. Strychnos Horsfieldiana MIQ. Fl. Ned. Ind. II, 379; HILL in Kew Bull. 1911, 294 und Kew Bull. 1917, 179.

Java: Nach MIQUEL bei Patjitan in der Res. Madioen (HORSFIELD); ferner Res. Banjoemas: Noesa Kambangan (KOORDERS no. 27050 β); Res. Batavia: Depok Sh. ± 100 m (BURCK & DE MONCHY, BEUMÉE no. A 162, BACKER no. 26301, KOORDERS no. 40203 β, 33432 β, 31196 β, 31197 β, 41714 β); Hügel von Djamboe westl. von Buitenzorg Sh. 175 m (BACKER no. 21075); G. Tendjoleat bei Djasinga Sh. 450 m (BACKER no. 10379); G. Tjisodong bei Leuwiliang Sh. 275 m (BACKER no. 26351); Res. Kediri: Prigi Sh. 5 m (BACKER no. 11816); Res. Pasoeroean: Urwald Soember Tangkil Sh. 400—500 m (KOORDERS no. 23621 β); Res. Preanger: Naturmonument-Insel im See von Pendjaloe (KOORDERS no. 47873 β).

13. Strychnos palembanica MIQ. Fl. Ned. Ind. Suppl. 227, 551; HILL Kew Bull. 1911, 293 und Kew Bull. 1917, 179. — *Str. Pilgeriana* GILG in Notizbl. kgl. bot Gart. Berlin I, (1897), 268.

Sumatra: Insel Simaloer (ACHMAD no. 735); Palembang, Moeara Enim (TEYSMANN no. 3669); nach HILL 1911 (FORBES no. 3245 & 2955 a).

14. Strychnos ligustrina BL. Rumphia I, 68, t. 25; HILL in Kew Bull. 1911, 286 und Kew Bull 1917, 193. — *Str. nux vomica* L. forma *depauperata* MIQ. Fl. Ned. Ind. II, 378; KOORDERS & VALETON Boomsoorten op Java, Bijdr. IX, (1903), 66.

Bali: Pinpatagoeng Sh. 20 m (BECKING no. 61).

Kangean—Archipel: Insel Saboenten Sh. 10 m (BACKER no. 29908); Insel Paliat Sh. 10 m (BACKER no. 29634).

Java: Res. Banjoewangi: Badjoelmati (TEYSMANN); Res. Pasoeroean: Binor bei Kraksaan Sh. 25 m (BACKER no. 13086).

Timor: Koepang (TEYSMANN no. 8969); ohne nähere Ortsangabe (ZIPPEL); von einer Forstprüfstation eingeschickt ohne Nummer und ohne Ortsangabe. Ferner nach HILL 1917: Koepang (R. BROWN); (Spanoghe 19, 1911, 32).

15. Strychnos cuspidata HILL in Kew Bull. 1909, 359, HILL in Kew Bull. 1911, 288 und Kew Bull. 1917, 199.

Borneo: Zentral-Borneo (Exp. NIEUWENHUIS).

16. Styrchnos Tieuté LESCH. in Ann. Mus. Hist. Nat. XVI, 479, 23; BLUME Rumphia I, 67, tab. 24; HILL in Kew Bull. 1917, 200.

Java: Res. Bantam: zwischen Malingping und Penjawoengan, Sh. 1 m (BACKER no. 1511); Res. Besoeki: Banjoewangi (TEYSMANN); bei Poeger (ZOLLINGER no. 2706); Res. Pasoeroean: bei Klakka (ZOLLINGER no. 2635); Tangkil (KOORDERS no. 23682 β); Res. Pekalongan: Urwald Asinan bei Soebah (KOORDERS no. 27525 β); Res. Preanger: bei Plaboeanratoe (KOORDERS no. 33165 β). Nach HILL ohne nähere Angaben: (TEYSMANN; HALLIER; REINWARDT no. 1599; HORSFIED no. 368; PULLE; KURZ).

Kultiviert im botan. Garten zu Buitenzorg; X G 46.

17. Strychnos ovalifolia WALL. Cat. 1592; HILL in Kew Bull. 1917, 201. — *Str. Beccarii* GILG in Notizbl. kgl. bot. Gart. Berlin I, (1897), 267.

Borneo: Soengei Landak (TEYSMANN); — nach GILG (BECCARI no. 1580); — nach HILL: Borneo, Amai Ambit (Liang Kutang); S. Mandai, 114° 8' ÖL, 0°40' NB. (HALLIER no. 3153 B).

18. Strychnos celebica KOORDERS Meded. 's Lands Plantentuin XIX, 540 & 631.

Celebes: Urwald bei Karowa, Tompaso (KOORDERS no. 17740 β).

VIII. GARDNERIA WALL.

In ROXB. Fl. Ind. ed CAREY I, 400; SOLEREDER in Ber. d. deutsch. bot. Ges. VIII, (1890), 90; SOLEREDER in E. & P. IV/2, 41 und Nachträge zu IV/2, (1897), 282; RACIBORSKI in Anzeiger d. Akad. d. Wiss. Krakau 1896, 205.

Gardneria ovata WALL. in ROXB. Fl. Ind. I, 400; RACIBORSKI in Anzeiger d. Akad. D. Wiss. Krakau 1896, 206.

Java: Res. Preanger: Tjadas Malang bei Tjibeber Sh. ± 1000 m (J. J. SMITH No. 749,).

IX. PSEUDOGARDNERIA RACIB.

In Anzeiger d. Akad. d. Wiss. Krakau 1896; SOLEREDER in E. & P. Nachtr. zu IV/2, (1897), 282.

Die beiden Arten *Ps. angustifolia* (WALL.) RACIB. und *Ps. nutans* (S. & Z.) RACIB. kommen zwar meines Wissens nicht in Niederl.-Indien vor, doch werden sie als Bewohner Japans und Ostindiens angegeben. Ich nehme aber diese Gattung doch hier auf, um Irrtümer, die sich in der Literatur finden, richtig zu stellen. RACIBORSKI gibt als Unterscheidungsmerkmale an: *Gardneria*, 4 Staubblätter, einfächerige Antheren zu einer Röhre verwachsen, in jedem Fruchtfach eine Samenanlage; *Pseudogardneria*, 4—5 Staubblätter, frei, Antheren 2fächerig, in jedem Fruchtfach 2 bis viele Samenanlagen. Und doch findet sich in den obenerwähnten Nachträgen zu E. & P. bei *Ps. angustifolia* die Angabe: 1 Sa. in jedem Fruchtfach. Ferner heisst es am selben Ort in der Gattungscharakteristik von *Pseudogardneria* „Gr. mit

knopfiger oder zweilappiger Narbe". Und weiter unten in der kurzen Beschreibung der beiden einzigen Arten wird bei beiden Arten die Narbe als 2lappig bezeichnet. Nach meinen Untersuchungen hat *Ps. angustifolia* wohl eine zweilappige Narbe, jedoch ist bei *Ps. nutans* die Narbe knopfförmig, was auch bereits SOLEREDER (Studien über die Tribus der *Gaertnereen* BENTH. *Hook.* in Ber. d. Deutsch. bot. Ges. VIII, 1893 (93) richtig anführt.

X. COUTHOVIA A. GRAY.

In Proc. Am. Acad. IV (1858), 324; BENTHAM & HOOKER Gen. pl. II, 797; SOLEREDER in E. & P. IV/2 41.

Couthovia celebica KOORDERS, Verslag eener Botan. Dienstreis door de Minahasa 1898, 537.

Celebes: Pangkadjene (TEYSMANN no. 11881); Minahasa, bei Loboe Ranoe Ketan Sh. 300 m (KOORDERS no. 18628 β, 18741 β).

Molucken: Ambon: (TEYSMANN H. B. 5531);

XI. CRATERIPHYTUM SCHEFF. ms.

BOERLAGE, Handleiding Fl. Ned. Ind II 2, (1899), 455; KOORDERS, Beschreibung der Loganiaceen-Gattung Crateriphytum SCHEFF. in Bull. Inst. bot. Buitenzorg XVI, (1903); E. & P. Nachtr. II zum II. — IV. Teil 291.

Crateriphytum moluccanum SCHEFF. in KOORDERS Beschr. d. Loganiaceen-Gattung Crateriphytum Scheff. Bull. Inst. bot. Buitenzorg XVI. (1903), 10.

In der Abhandlung von KOORDERS möchte ich einen Irrtum richtigstellen. Auf Seite 8 oben sagt KOORDERS bei der Beschreibung der Narbe: „ . . . . stigma clavatum bilobum . . . ." und auf derselben Seite unten: „Jedoch ist *Crateriphytum* durch die einfache Narbe . . . . . ". Dieser Widerspruch findet sich bereits bei BOERLAGE a. a. O. 456, von wo er von KOORDERS übernommen wurde.

Meine Untersuchungen ergeben, dass die Narbe tatsächlich *zweilappig* ist. Die Narbenlappen sind aber anfangs geschlossen und öffnen sich erst später. Dadurch wird namentlich bei Herbarmaterial der Eindruck der Einfacheit erweckt. Auch an Alkoholmaterial findet man nicht oft das offene Stadium.

Molucken: Ceram bei Maneo Sh. 500—600 m (RUTTEN no. 234); W. Beka, Sh. 0—1000 m (RUTTEN no. 1768); Ambon, Hoetoemoeri (?); Ambon, G. Hassoe (BOERLAGE no. 112); Ambon, (BINNENDIJK no. 18499 & 98); Batjan (TEYSMANN no. 5896).

Kultiviert im botan. Garten zu Buitenzorg: II J 18; IV E 92 & 92a.

XII. FAGRAEA THUNB.

Nov. Gen. 34; SOLEREDER in E. & P. VI/2, 41.

Die Durchsicht des *Fagraea* - Materials liess eine eingehendere Bearbeitung dieser Gattung wünschenswert erscheinen, einerseits weil eine Zahl von Artnamen unklar ist, andrerseits weil einige im Gebiet von Niederländisch-Indien in der letzten Zeit gesammelten Arten zweifellos neu sind und einer Beschreibung und Einreihung bedürfen.

Die Gattung *Fagraea*, die systematisch eine recht einheitliche Gruppe darstellt, bietet gerade aus diesem Grunde einige Schwierigkeiten. Die Form der Blätter und Blüten zeigt nur wenige auffallende Unterschiede, sodass eine eindeutige Beschreibung oft recht schwierig ist. Blätter desselben Baumes variieren oft stark in Form und Grösse; auffallend ist dieser Umstand bei *Fagraea racemosa*, was im Verein mit der wechselnden Länge der Blütentraube zu der Aufstellung einer ganzen Reihe angeblich neuer Arten geführt hat. Es erscheint daher angezeigt, diese Art sowie einige andere weiter zu fassen.

Ausser der Traube bei *F. racemosa* und andern Arten, die teils aus Einzelblüten, teils aus zymösen Teilinfloreszenzen besteht, ist der Blütenstand bei *Fagraea* meist ein zymöser oder besser gesagt ein thyrsoider und meist endständig. Jedoch besteht dieser scheinbar endständige Blütenstand gewöhnlich aus einer echten endständigen Infloreszenz und aus ähnlich gebauten, meist aus weniger Blüten bestehenden, seitenständigen Blütenständen, die aus den Blattachseln hervorgehen und gemeinsam mit dem echten endständigen einen einheitlichen Blütenstand bilden. Die Aufblühfolge ist eine zentrifugale. Die Kelchdeckung ist bei allen *Fagraea*-Arten eine quincunciale. Die Blumenkrone ist trichterig, fünfzipfelig; die Zipfel liegen in der Knospenlage rechtsgedreht, d.h. der rechte Rand jedes Zipfels überdeckt den linken Rand des danebenstehenden (EICHLER [1]). Einige Autoren sprechen allerdings von Linksdrehung, da die Drehung der des Uhrzeigers entgegengesetzt ist. Die Staubblätter sind in der Fünfzahl vorhanden, stehen zwischen den Blumenkronzipfeln und sind mehr oder weniger tief in der Röhre angewachsen. Die Antheren sind meist an der Basis gespalten und am Rücken befestigt. Der Griffel, gewöhnlich kräftig gebaut, trägt eine knopf- oder scheibenförmige Narbe. Die Frucht ist eine Beere, mehr oder weniger vollständig zweiteilig und enthält zahlreiche kleine Samen. Aussen ist die Frucht meist mit einer pergamentartigen, glänzenden Haut überzogen, die sich an der reifen Frucht leicht ablösen lässt und unter der sich oft eine weissliche, stark klebrige Schleimschicht befindet.

Einige allgemeine Bemerkungen wären noch über die Blütenfarbe zu machen. Die Farbe der frisch eröffneten Blüten ist gewöhnlich weiss, seltener hellgelb, oft stellenweise grün. Aber auch die weisse Blütenfarbe verändert sich bald an den Blüten, deren Lebensdauer nur kurz ist, in eine gelbe. Namentlich bei den grossblütigen Formen zeigen auch die Lappen der frisch eröffneten Blüten zweierlei Farben. So ist der Teil der Kronlappen, der in der Knospenlage gedeckt ist, reinweiss, während der ungedeckte hellgelb ist. Beide Farben sind scharf von einander abgegrenzt. Beim Verblühen nimmt dann der weisse Teil eine hellgelbe, der ursprünglich hellgelbe Teil dunkelgelbe Färbung an. Die Blüten mancher Arten sind wohlriechend.

Die Blätter sind stets gegenständig, glatt, ganzrandig (Ausnahme: *F. crenulata*). Sie sind gestielt und haben an der Basis Stipulargebilde, die

[1]) EICHLER: Blütendiagramme I, 1875, 7.

mehr oder weniger stark ausgebildet sind, manchmal aber durch typische Ausbildung ein gutes Artmerkmal abgeben *(F. auriculata, imperialis, obovata, fastigiata, borneensis).*

Die Wuchsform ist sehr verschieden; es gibt unter den *Fagraea*-Arten Bäume, Sträucher, Lianen und Epiphyten. Die Wuchsform kann als bestimmendes Merkmal kaum verwendet werden, denn dieselbe Art kann je nach dem Ort ihres Vorkommens verschiedenen Habitus haben.

Der Kelch ist bei allen *Fagraea*-Arten ausdauernd und wächst auch postfloral noch mehr oder minder stark. Es ist daher zu beachten, dass die Masse, die in der Beschreibung der einzelnen Arten angeführt sind, sich auf den Kelch der vollerblühten Blüte beziehen; ebenso ist bei den Massangaben der Blätter zu berücksichtigen, dass die Längenmasse nur die Länge der Blattfläche angeben, da die Länge des Blattstieles gewöhnlich getrennt angeführt ist.

Bei einigen Arten fand ich Milchsaft und zwar ist dieser an den verschiedensten Orten zu finden. So zeigt sich an der Vegetationsspitze (*F. imperialis, auriculata, borneensis* u. a.) zwischen der sich berührenden Basis der Blattstiele und Stipularen der beiden gegenüberstehenden Blätter und der darunter befindlichen Anlage des jungen Blattpaares ein weisser, dickflüssiger Saft, der beim Durchbrechen des jungen Blattpaares an die Luft tritt und hier gerinnt und dann oft weisse Tropfen und Überzüge an den jungen Blättern bildet. Ferner überzieht unter der pergamentartigen Haut der Früchte (*F. litoralis, lanceolata, borneensis, imperialis, auriculata, euneura*) ein weisser, dicker Saft die ganze Frucht, der sehr klebrig ist und sich zu langen, elastischen Fäden ausziehen lässt. In den Kelchen einiger Arten (*F. imperialis, auriculata, lanceolata, carnosa* u a.), die reichlich Wasser zwischen Kelchblättern und Blumenkronröhre enthalten (sehr viel bei *F. imperialis*!), ist dieses Wasser trüb, milchig und klebrig und lässt beim Verdunsten einen weissen Niederschlag zurück. In Alkohol ist der Milchsaft zum Teil löslich, gibt aber ausserdem einen Niederschlag.

Dort, wo der Milchsaft an der Vegetationsspitze ausgeschieden wird, fand ich an der Basis der Blattstiele und Stipeln Zotten, die denen ähneln, die J. HANSTEIN (Ueber die Organe der Harz-und Schleimabsonderung. Botan. Zeitung 1868, S. 712, Taf. XI. 37) bei *Coffea* beschreibt und abbildet. Milchsaftröhren konnte ich nirgends feststellen. Nie fand ich Milchsaft in Blättern und Zweigen; ebenso nie in der Rinde, wie es KOORDERS für ein Exemplar von *F. auriculata* (no 4323 *β*) in KOORDERS und VALETON (Boomsoorten op Java, Bijdr. IX, 77) angibt. Ausser dieser einen Angabe in der Literatur fand ich im Herbar auf einer Etikette eines javanischen Exemplares von *F. obovata* (WINCKEL no. 332) die Notiz: „melksap als kleefstof gebruikt voor lijmstokken, om vogeltjes te vangen." Von welchem Teil der Pflanze dieser Milchsaft aber herrührt, ist nicht gesagt.

Schlüssel zur Bestimmung der Arten.

1a Blütenstand traubig; Traube aus Einzelblüten oder kleinen zymösen Teilinfloreszenzen zusammengesetzt 2

1b Blütenstand andersartig 5
2a Blätter meist gross, breit elliptisch . . . . 1 *F. racemosa* JACK.
2b Blätter mehrmals länger als breit 3
3b Blätter sehr schmal und lang, schwach säbelförmig gebogen . . . . . 2 *F. eucalyptifolia* nov. spec.
3b Blätter ungefähr 2—3 mal so lang als breit, lanzettförmig, oft fast paralellrandig oder eiförmig 4
4a Blätter ungefähr 3 mal so lang als breit, lanzettförmig, oft fast paralellrandig. . . . . 3 *F. Teysmannii* nov. spec.
4b Blätter länglich eiförmig, Blütenstand armblütig . . . . . 4 *F. gracilis* nov. spec.
5a Blütenstand bildet sehr reichblütige Schirmrispen; Blüten verhältnismässig klein, nicht über $1^1/_2$ cm lang; Staubblätter weit aus der Röhre hervorragend 6
5b Blüten mittelgross bis sehr gross; Staubblätter wenig oder gar nicht aus der Blüte hervorragend 9
6a Blütenstand endständig; [1]) Blumenkronröhre zylindrisch, Staubblätter am Schlunde befestigt 7
6b Blütenstand achselständig; Blumenkronröhre nach oben trichterig erweitert; Staubblätter im oberen Viertel der Röhre angewachsen. 8
7a Blätter elliptisch, am oberen Ende zugespitzt. 5 *F. elliptica* ROXB.
7b Blätter breit elliptisch bis eiförmig, am oberen Ende abgerundet . . . . . 6 *F. sumatrana* MIQ.
8a Blätter gewölbt, mit zahlreichen Seitennerven. 7 *F. fragans* ROXB.
8b Blätter flach, mit wenig Seitennerven, lang gestielt. . . . . 8 *F. sororia* J. J. SMITH n. sp.
9a Blätter ganzrandig. 10
9b Blätter fein gekerbt; Blütenstand trichotom verzweigt, reichblütig . . . . . 9 *F. crenulata* MAING.
10a Blüten einzeln, sitzend . . . . . 12 *F. carnosa* JACK.
10b Blüten zu Blütenständen vereinigt 11
11a Blüten mit langer zylindrischer oder oben nur wenig erweiterter Röhre (Longiflorae) 12
11b Blumenkronröhre nach oben sich rasch erweiternd (Latiflorae) . . 14
12a Blätter am Grunde geöhrlt . . . . 15 *F. borneensis* SCHEFF.
12b Blätter am Grunde nicht geöhrlt 13
13a Blüte mit grossen Vorblättern, Röhre der Blumenkrone höchstens 3mal so lang als die Lappen; Blätter breitelliptisch, gross, mit kurzer Spitze. . . . . 13 *F. bracteosa* nov. spec.
13b Blüte mit kleinen Vorblättern, Röhre der Blumenkrone ungefähr 7—8mal solang als die Lappen; Blätter mit langer Träufelspitze . . . . . 14 *F. tubulosa* BL.

[1]) Sehr häufig ausser dem endständigen Blütenstand noch in den Achseln des darunter (seltener auch des nächstfolgenden) stehenden Blattpaares je ein ähnlich gebauter Blütenstand, die aber mit dem echten endständigen einen scheinbar einheitlichen Blütenstand bilden.

14a Blätter am Grunde geöhrlt; Öhrchen oft sehr klein 15
14b Blätter am Grunde nicht geöhrlt 18
15a Blattfläche am Blattstiel herablaufend und an dessen Basis in 2 kleine ohrförmige Anhängsel übergehend; Blütenstand vielblütig . . . . . 10 *F. fastigiata Bl.*
15b Blattfläche nicht am Stiel herablaufend; Blütenstand meist 3blütig, höchstens 5blütig 16
16a An der Basis des Blattstieles 2 grosse, ohrförmige, blattartige, gewölbte Nebenblätter; junge Zweige mit schafkantigen Leisten 17
16b An der Basis des Blattstieles schr kleine, knorpelige Höcker; junge Zweige abgerundet . . . . . 18 *F. euneura* SCHEFF.
17a Blüten sehr gross, ungefähr 25 cm lang, Filamente weiss; Leisten der Internodien oben spitz zulaufend. 17 *F. imperialis* MIQ.
17b Blüten gross, ungefähr 13 cm lang; Filamente blass rötlichviolett; Leisten der Internodien oben stumpf. 16 *F. auriculata* JACK.
18a Blütenstand 3—7 blütig. 19
18b Blütenstand vielblütig 24
19a Blüten sitzend oder fast sitzend; Blätter dick lederig . . . . . 23 *F. acuminatissima* MERRILL.
19b Blüten gestielt 20
20a Blumenkronröhre in Innern ungefähr in der Mitte mit einem Ring . . . . . 24 *F. annulata* HIERN.
20b Blumenkronröhre ohne solchen Ring 21
21a Blütenstand endständig an Langtrieben 22
21b Blütenstand endständig an Seitentrieben, die oft schr kurz sind, dadurch scheinbar achselständig; Blüten gelb, Blätter dünn . . . . . 22 *F. lutea* nov. spec.
22a Blätter lanzettförmig . . . . . 21 *F. lanceolata* BL.
22b Blätter im Allgemeinen elliptisch. 23
23a Frucht kugelig oder fast kugelig, mit Griffelrest an der Spitze. . . . . 19 *F. litoralis* BL.
23b Frucht länglich, oben spitz ausgezogen, mit Griffelrest an der Spitze . . . . . 20 *F. amboinensis* BL.
24a Blätter verkehrt eiförmig, an der Basis des Blattstieles kräftig ausgebildete Stipulargebilde; Blumenkronröhre oben bauchig erweitert . . . . . 11 *F. obovata* WALL.
24b Blätter eiförmig, an der Basis des Blattstieles nur mit schwachem Stipularrand; Blumenkronröhre sich nach oben allmählich erweiternd. . . . . 22 *F. lutea* nov. spec.

1. **Fagraea racemosa** JACK in ROXB. Fl. Ind. ed. CAREY II, 35; Miq. Ann. Mus. bot. Lugd. Bat. II, 218 und die dort angegebenen Synonyma. *F. morindaefolia* BL. Rumphia II, 32, tab. 73 fig. 2 & tab. 79.—*F. cordifolia* BL. Rumphia II, 33.—*F. subreticulata* BL. Mus. bot. Lugd. Bat, I, 171.—*F. ligustrina* BL. Rumphia II, 33.—*F. cuspidata* BL. Mus. bot. Lugd. Bat. I, 170.

Stattlicher Baum oder bisweilen Strauch; Zweige glatt, rund, im trockenen Zustand gewöhnlich gelbbraun bis braunrot; die Nodien der Zweige verdickt. Blätter gegenständig, ganzrandig, lederig, gestielt; Form und Grösse derselben sehr veränderlich, meist jedoch breit elliptisch oder rundlich elliptisch, bisweilen aber auch schmäler, an der Spitze stumpf oder mit kurzer Spitze, an der Basis abgerundet oder keilförmig, Länge 10—30 cm, Breite 8—16 cm. Mittelrippe beiderseits deutlich, auf der Unterseite stark hervorspringend, Seitennerven ebenfalls deutlich 6—10 Paare; im trockenen Zustand gelbgrün oder braungrün, Blattstiel 2 cm lang an der Basis verbreitert mit mehr oder weniger deutlichem, stengelumfassenden, ringförmigen Stipularrand. Blütenstand traubig, aus Einzelblüten oder armblütigen, zymösen Teilinfloreszenzen bestehend, lang, hängend, lockerblütig oder auch kurz mit dicht gedrängten Blüten; meist endständig, selten neben solchen auch noch seitenständige. Blüten mehr oder weniger lang gestielt oder fast sitzend, an der Basis des Blütenstieles 2 transversal gestellte Vorblätter. Kelch eiförming, quincuncial, ungefähr 0,75 cm lang, 5lappig; Lappen breit, oben abgerundet, etwas mehr als die halbe Länge des Kelches betragend; Blumenkrone trichterförmig mit zurückgebogenen linealen Lappen; Röhre 2 cm lang, Lappen 1 cm lang und 0,75 cm breit; Staubblätter in der Mitte der Röhre befestigt, aus dieser hervorragend; Filamente fädlich, 2 cm lang; Antheren elliptisch, 4 mm lang, Antherenhälften unten auseinander ragend, am Rücken befestigt; Fruchtknoten ellipsoidisch, Griffel kräftig, 2 cm lang, gebogen; Narbe flach, scheibenförmig, Rand nach abwärts gebogen, schief zur Längsachse stehend; Frucht eiförmig, an der Spitze einen kurzen Rest des Griffels tragend, unvollständig zweifächrig, Länge ungefähr 2 cm, grösster Querdurchmesser ungefähr 1 cm; Samen sehr zahlreich, klein, braun.

Borneo: Landak, Pariet Demah (TEYSMANN); Sintang (TEYSMANN no. 8530 & 8531); ohne nähere Ortsangabe (JAHERI); (Exp. NIEUWENHUIS, JAHERI no. 7, no. 161); Goenoeng Talian bei Martapoera (Lot Abi no. 2172) [1]); Awang Bongkal bei Martapoera (RAMLI no. 1882) [1]); Boekit Milie (Exp. NIEUWENHUIS 1898—99, AMJAH no. 164); Poeloe Madjang (TEYSMANN no. 8535); Oeloe Bloe-oe (Exp. NIEUWENHUIS 1898—99, AMDJAH no. 275); Soengei Bloe-oe (Exp. NIEUWENHUIS 1896—97, JAHERI no. 1060).

Ceram: Roho Sh. 100—200 m (Exp. RUTTEN, KORNASSI no. 469); westl. v. Seleman Sh. 0—100 m (RUTTEN no. 2012).

Celebes: Kp. Tapatang (Exp. v. VUUREN, NOERKAS no. 446).

Java: Res. Bantam: Sh. 300—400 m (BACKER no. 330); G. Rompang Sh. 10—200 m (KOORDERS no. 4340 β); zwischen Malingping und Pajawoengan Sh. 5 m (? no. 1485); Res. Batavia: bei Tjampea Sh. 150 m (KOORDERS no. 30508 β); bei Buitenzorg (HALLIER); G. Tjibodas, Tjiampea Sh. 200 m (DEN BERGER no. 392); Nordfuss des G. Tjibodas bei Tjiampea Sh. 100 m (BACKER no. 25435); G. Paroengpoeng bei Tjiampea Sh. 750 m (BAKHUIZEN

[1]) Auf den Etiketten dieser beiden Spannbogen steht als einheimischer Name „mengkoedoe" und „mengkoedoe oetan"; bei ersterem steht noch ferner die Notiz „Gebruikt bij batik". Ich halte beide Angaben für einen Irrtum. Mengkoedoe heissen bei den Eingeborenen verschiedene Morinda — Arten, deren Bast Farbstoff für die Batikindustrie liefert und mit welchen die beschriebene Fagraea-Art im Blatte eine gewisse Ähnlichkeit hat.

V. D. BRINK no. 4175); Barengkok bei Leuwiliang Sh. 200 m (BAKHUIZEN V. D. BRINK no. 768); Res. Preanger: Rawah apoe bei Kali Poetang Sh. 10 m (BACKER no. 4466); Palaboeanratoe, Soekaboemi (KOORDERS no. 11777 β, 4338 β, 33097 β, 12281 β; 4337 β); Res. Banjoemas: Noesa Kambangan bei Tjilatjap (KOORDERS no. 4341 β, 4342 β).

Neu Guinea: Kaiser Wilhelmsland, Konstantinhafen (HOLLRUNG no. 628); Nordküste, Kampong Horne (Exp. WICHMANN 1903, ATASRIP no. 47); Merauke (Exp. KOCH 1904—05. ZIPPEL); Mysole Waigama (TEYSMANN); bei Kampong Gelieb (BRANDERHORST no. 182).

Sumatra: Insel Simaloer (ACHMAD no. 295, 175); Sidjoengdjoeng (TEYSMANN no. 991); bei Padang Sh. 100 m (KOORDERS no. 10342 β); Bengkoelen (Exp. JACOBSON, AJOEB no. 21); Palembang, Moeara Enim (TEYSMANN no. 3923); Alaslanden (Exp van Daalen 1904, no. 373); ohne nähere Ortsangaben (JUNGHUHN).

Kultiviert im botan. Garten zu Buitenzorg: IV A 112; V D 59.

Wie schon oben erwähnt sind die Blätter sowohl der Form als auch der Grösse nach sehr verschieden; hiezu kommt auch noch eine ausserordentlich grosse Veränderlichkeit der Blütenstände. Vom selben Baum kann man sowohl Blätter wie Blütenstände in der verschiedensten Ausbildung sammeln. Da aber sowohl die Blattform, wie die grössere oder geringere Reichblütigkeit der Blütenstände, Grösse des Blütenstiels vielfach als Artmerkmal verwendet wurden, entstanden eine grosse Zahl neuer Arten, deren Bestehen sich kritisch nicht rechtfertigen lässt. Ich fasse den Artbegriff von *F. racemosa* weiter und betrachte den Mangel, einzelne örtliche Varietäten nicht als solche abgetrennt zu haben, für geringer, als die wahllose Aufstellung neuer Arten, deren eindeutige Abgrenzung sich nicht geben lässt, da sie untereinander durch zahllose Übergänge verbunden sind.

2. **Fagraea eucalyptifolia** nov. spec. Abb. 2, Fig. 1—3.

Ramuli teretes, nodis incrassatis. Folia opposita, integerrima, coriacea, longa, angusta, plurimum acinaciformia, apice acuta, basi cuneata, 16—30 cm longa, $1^1/_2$ summum 2 cm lata, in sicco supra glauca, infra fusca vel violacea, margine recurvo; costa media supra plana, infra prominente et carinata; venis transversis numerosis utrinque subperspicuis. Petioli firmi, circiter 2 cm longi incrassati, supra subcaniculati; stipulae margine angusto amplexicaules. Racemus terminalis, basi cymis trifloris, ad superiorem finem floribus singulis compositus. Cymae et flores singuli in axillis bractearum triangulatarum, acutarum.

Flores pedunculati, basi pedunculi duobus bracteis transversalibus, acutis, triangulatis. Calyx quincuncialis, campanulatus, quinquepartitus, circa $1^1/_2$ cm longus, laciniis quinis, rotundatis, margine membranaceo, tubo aequilongis. Corolla infundibuliformis, quinque laciniis; tubus circa $1^1/_2$ cm longus, superiore parte ventricosus, lobi lati, rotundati, circa $^1/_2$ cm longi, reflexi Stamina quinque, in tertia parte superiore tubi affixa; filamenta filiformia; antherae paulum exsertae, in dorso medio affixae. Stylus $1^1/_2$ cm longus, in parte superiore flexus; stigma obtusum, depressum,

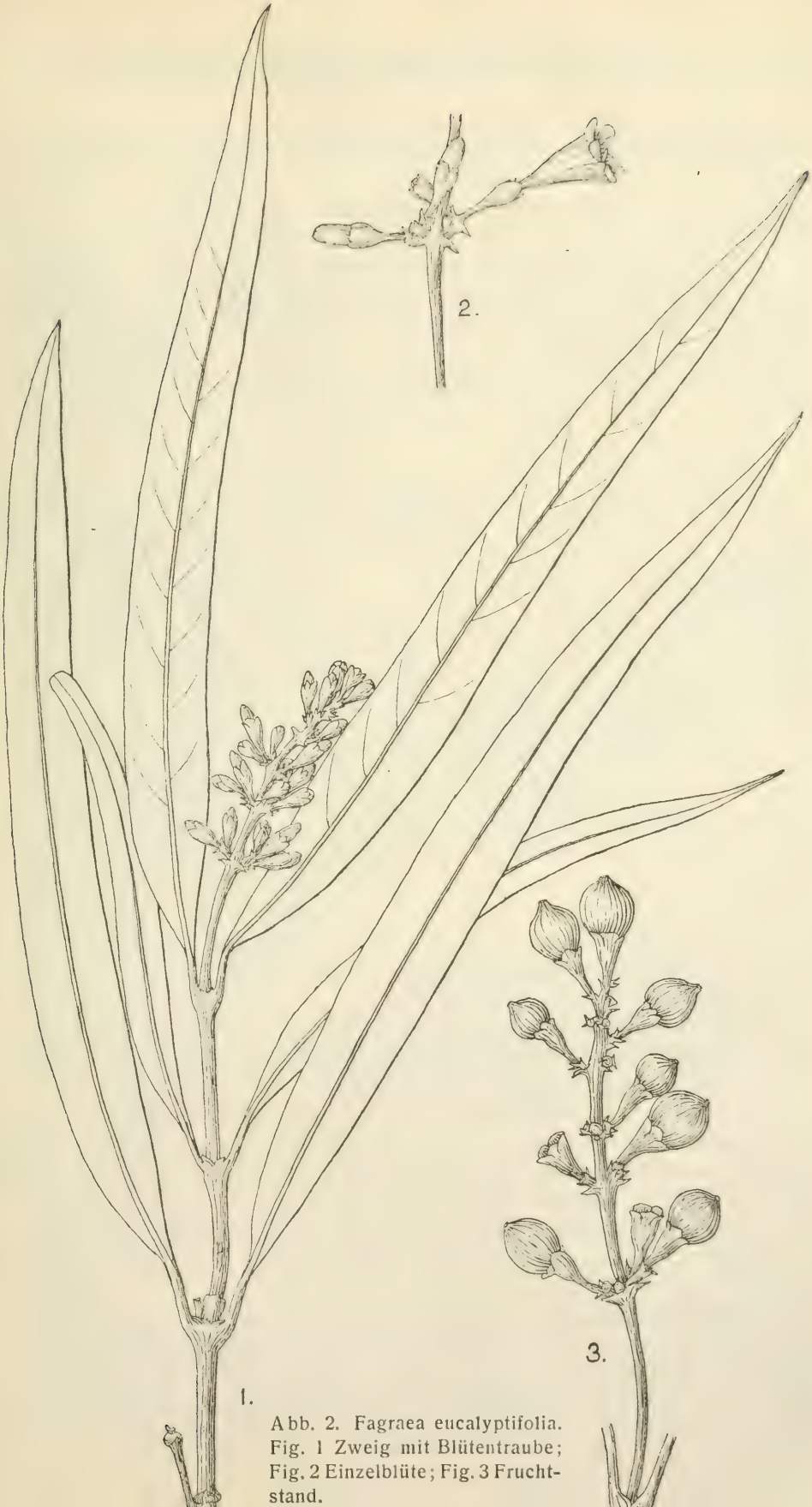

Abb. 2. Fagraea eucalyptifolia. Fig. 1 Zweig mit Blütentraube; Fig. 2 Einzelblüte; Fig. 3 Fruchtstand.

non e tubo exsertum. Fructus ovoideo-globosus, in vertice basi styli brevissime mucronatus, pisi magnitudine; semina numerosa, parva, nigra, angulata.

Borneo: Soengei Parij (Exp. NIEUWENHUIS 1896—97, JAHERI, AMDJAH no. 552).

Diese Art ist vornehmlich durch die langen, schmalen Blätter, die ähnlich den Blättern von *Eucalyptus* leicht säbelförmig gebogen sind, von den andern *Fagraea*-Arten mit traubigen Blütenständen zu unterscheiden. Die Blüten sind denen von *F. racemosa* ähnlich, jedoch etwas kleiner und die Staubblätter sind in der Röhre gegen das obere Ende zu angewachsen und nicht wie bei *F. racemosa* in der Mitte.

3. Fagraea Teysmanii nov. spec. Abb. 3.

Ramuli glabri, teretes, internodiis fere aequalibus (5—8 cm longis), nodis incrassatis. Folia integerrima, opposita, petiolata, coriacea, lanceolata vel saepissime paralellis marginibus, apice plus minus acuminata, basi cuneata vel rotundata, 18—30 cm longa, 5—9 cm lata, costa media in sicco supra concava, subtus prominente, venis transversis perspicuis, subtus saepe subprominentibus, in sicco margine recurvo. Petiolus firmus, $1^1/_2$ cm longus, basi lata insidens, margine stipulare angusto amplexicaule. Racemus terminalis vel inderdum axillaris, pauciflorus, floribus singulis et nonnullis cymis trifloris compositus. Flores breviter pedunculati, basi pedunculi 2 parvis bracteis transversalibus squamosis, obtusis vel rotundatis. Calyx proculiformis, quincuncialis, quinquepartitus, circa 6—8 mm longus, laciniis 4 longis, rotundatis; corolla infundibuliformis, 3,2 cm longa; tubus 2,5 cm longus, parte inferiore angustus, parte superiore ampliatus, laciniae aequales 7 mm longae, rotundatae. Stamina in tubo medio affixa, e tubo exserta, filamentis filiformibus, 18 mm longis, antheris ellipticis, in dorso medio affixis, basi bifidis; stylus 2,2 cm longus, stamina non superans. Fructus pisi magnitudine, orbicularis, apice cicatricula styli mucronatus, seminibus numerosis, rubicundis.

Borneo: Bloe-oe (Exp. NIEUWENHUIS 1896—97, JAHERI no. 1430); Landak Ngabang (TEYSMANN); Karimata, Soengei Tajan (TEYSMANN); ohne nähere Ortsangabe (JAHERI).

Auch diese Art unterscheidet sich von den andern *Fagraea*-Arten mit traubigen Blütenständen vor allem durch die Form der Blätter, die auffallend verschieden sind. Sie sind lanzettlich oder auch breit linear und haben eine scharf abgesetzte Träufelspitze, die bald grösser bald kleiner sein kann. Die Zahl der Seitennerven ist verhältnismässig gering. Die Nodien der Zweige sind wie auch bei den andern razemösen *Fagraea*-Arten verdickt.

Die Blütenstände stehen meist endständig, doch kommen auch seitenständige oft vor. Sie sind kurz und wenigblütig. Die Einzelblüte zeigt keine auffallenden Verschiedenheiten den andern Arten dieser Gruppe gegenüber; jedoch ist der Rand der Kelchblätter nicht so ausgesprochen häutig, als es sonst der Fall ist.

Abb. 3. Fagraea Teysmannii.

4. Fagraea gracilis nov. spec. Abb. 4 Fig. 1—3.

Ramuli teretes, proceri, nodis incrassatis, internodiis $5^1/_2$—6 cm longis; folia opposita, oblongo-ovata, apice acuta, basi rotundata, 13—19 cm longa, 5—7 cm lata, tenui-coriacea, in sicco fusca vel olivacea, costa media supra plana, suptus prominente, cum decem paribus venarum transversarum utrinque perspicuarum, venis marginalibus conjunctarum; petioli firmi, $1^1/_2$ cm longi, stipularum margine angusto amplexicauli. Racemus terminalis, pauciflorus, paucis cymis trifloris et floribus singulis compositus. Flores breviter pedunculati, basi pedunculi 2 minimis bracteis squamosis acutis; calyx poculiformis, quincuncialis, quinquepartitus, circa 4 mm longus, laciniis 2 mm longis, rotundatis, margine membranaceo; corolla infundibuliformis, 2,5 cm longa, quinis laciniis; tubus 2 cm longus, faucem versus ampliatus; laciniae aequales, 5 mm longae, rotundatae, margine undulato.

Stamina in tubo affixa, e tubo exserta, filamentis filiformibus, $1^1/_2$ cm longis, antheris ellipticis, in dorso medio affixis; stylus 2,4 cm longus, exsertus, stamina non superans. Fructus mihi ignotus.

Borneo: ohne nähere Ortsangabe (Exp. NIEUWENHUIS 1896—97, JAHERI no. 169).

Die Nervatur ist auf der Unterseite der Blätter besonders deutlich ausgeprägt. Die Zahl der Nervenpaare ist nahezu konstant 10; durch bogig verlaufende Randnerven sind die Seitennerven untereinander verbunden. Die Zweige sind schlank, die Blätter stehen in Abständen von ungefähr $5^1/_2$—6 cm. Die Blütenstände sind armblütig, die Einzelblüten schlank gebaut. Form, Zartheit und die regelmässige Nervatur der Blätter, sowie der kleineren, zarten Blüten unterscheiden diese Art von allen anderen Arten mit traubigen Blütenständen.

5. Fagraea elliptica ROXB. Fl. Ind. ed CAREY II, 32.—*F. speciosa* BL. Rumphia II, 35, tab. 81.—*Cyrtophyllum speciosum* BL. Bijdr. 1022.

Diese und die folgenden drei Arten gehören der Untergattung *Cyrtophyllum* MIQ. an. Es sind Formen mit verhältnismässig kleinen Blüten, die zu reichblütigen Schirmrispen vereinigt sind. Die typischen Merkmale von *Fagraea elliptica* sind: die endständigen, kleinblütigen Blütenstände mit ihren flachgedrückten, flach rinnigen Infloreszenzstielen, zylindrische Blumenkronröhne und die am Schlunde der Blumenkronröhne befestigten Staubblätter. Durch diese Merkmale unterscheidet sich diese und die folgende Art (*F. sumatrana*) von *F. fragrans* und *F. sororia*. Die Früchte sind orangegelb. Die Form und Grösse der Blätter ist das Unterscheidungsmerkmal zwischen *F. elliptica* und *F. sumatrana*. Die Blätter stehen an den Zweigenden dichtgedrängt und hinterlassen erhabene Narben. Die Blätter sind elliptisch, am oberen Ende zugespitzt, auf der Oberseite glänzend; ihre durchschnittliche Länge beträgt 15—18 cm, die Breite 7—8 cm. Die Blattnervatur ist deutlich sichtbar. Ausser den echten endständigen Blütenständen treten in den Achseln des obersten Blattpaares (selten auch des folgenden) ähnlich gebaute Infloreszenzen auf, die mit dem endständigen einen scheinbar einheitlichen, endständigen Blütenstand bilden. Die Blüten sind weiss und

Abb. 4. Fagraea gracilis; Fig. 1 blühender Zweig; Fig. 2 die Blütentraube vergrössert; Fig. 3 einzelnes Blatt.

wohlriechend. Die Formen aus grösserer Seehöhe (über 1100 m) zeigen derbere Blätter.

Java: Res. Batavia: G. Salak, Sh. 600—1000 m (KOORDERS no. 24247 β, no. 24461 β, no. 36689 β.); nördl. v. Tjanten bei Buitenzorg Sh. ± 700 m (BACKER no. 25048.); Res. Preanger: Tjibodas Sh. 1400 m (KOORDERS no. 42825 β, no. 40154 β); Soekaboemi, Sanggarawa Sh. 400 m (KOORDERS no. 4348 β, no. 4346); bei Palaboeanratoe (KOORDERS no. 4345 β); Geger Bintang, Sh. 1600 m (DEN BERGER no. 592).

Molucken: Ambon (ROBINSON no. 3037); Ambon, Hoetoemoeri (?). Ceram, Roho Sh. 100—200 m (Exp. RUTTEN, KORNASSI no. 502) blühend am 22 Nov. Riring, N. W. Ceram. Sh. 600—700 m (RUTTEN no. 2179).

Sumatra: Palembang Sh. ± 15 m (THORENAAR no. 77 E 1P 933, und 77 E 1P 746); Rawas Sh 150 m (GRASHOFF no. 1140); Habinsaran oso. vom Tobasee Sh. 1200—1300 m (LÖRZING no. 6568); O. Randgebirge des Tobasees ober Panahassan Sh. 1100—1250 m (LÖRZING no. 6660); Si Borong-Borong, Toba Sh. 1100m (OUWEHAND); Lampong Kehang, (TEYSMANN no 4309). Insel Simaloer: (ACHMAD no. 58); Landschap Tapah (ACHMAD no. 1515 & no. 1616).

Kultiviert im botan. Garten zu Buitenzorg: IV A 113. Ferner ein Spannbogen no. 16368; die Pflanze rührt nach den beiliegenden Notizen von Ambon her und wurde seinerzeit im botan. Garten kultiviert.

6. Fagraea sumatrana MIQ. Fl. Ned. Ind. II, 377.

Diese Art steht der eben beschriebenen Form sehr nahe, unterscheidet sich aber vor allem durch die Blätter. Diese sind länglich- bis breit-elliptisch, an der Basis in den Stiel zusammengezogen, an der Spitze abgerundet oder abgestumpft. Die Seitennerven sind an frischen Blättern schwach zu erkennen, an trockenen Blättern sind sie auf der Oberseite nur sehr schwach, auf der Unterseite gar nicht zu erkennen; an getrockneten älteren Blättern sind die Adern als dunkle, verästelte Linien zu sehen; die Länge beträgt 14—20 cm, die Breite 6—11 cm. An der Basis der Blütenstiele stehen kleine schuppenförmige Vorblätter. Die Frucht ist orangegelb.

Banka: Plangas (TEYSMANN).

Borneo: ohne nähere Ortsangabe TEYSMANN; KORTHALS).

Sumatra: Pajakombo (TEYSMANN no. 992).

Kultiviert im botan. Garten zu Buitenzorg: IV A 127.

Nutzen: Liefert gutes Bauholz.

7. Fagraea fragrans ROXB. in Fl. Ind. ed CAREY II, 32. — *F. peregrina* BL. Rumphia II, 34, tab. 80. — *Cyrtophyllum peregrinum* RWDT. in BLUME Bijdr. 1022.

Diese und die folgende Art haben zum Unterschied von den beiden vorhergehenden achselständige Blütenstände mit Blüten deren Kronröhre sich nach oben trichterig erweitert; die Staubblätter sind im obersten Viertel der Röhre angewachsen und an der Basis knieförmig gebogen. Die Blätter von *F. fragrans* sind lanzettförmig oder elliptisch, oben zugespitzt, an der

Basis in den Stiel verlaufend. Die Blattfläche ist gewölbt, auf der Unterseite konkav. Die Früchte sind orangerot. Die Blätter sind gegen das Ende der Zweige dichtgedrängt; die Zweigenden sind verdickt.

Borneo: Bandjermasin (Boschwezen no. 2176); Poeloe Madjang (JAHERI); ebenda (TEYSMANN no. 8536, no. 8537); Sintang (TEYSMANN no. 8538); British-Borneo Mount Kinabalu Trip (JESSELTON no. 9563).

Celebes: Mara (Exp. v. VUUREN, NOERKAS no. 222); Boni (Heyne no. 2863); ohne nähere Ortsangabe (HAM no. L,6).

Java: Res. Batavia: bei Buitenzorg (HALLIER no. 202); Res. Semarang: Ngarengan kult. Sh. 50 m; (KALSHOVEN); ebenda (BEUMÉE no. 5029); Res. Soerabaja: Insel Bawean, Tambak (TEYSMANN no. 1767).

Sumatra: Palembang, Moesi-Oeloe Sh. 20 m (ENDERT no. 160, no. 161); Palembang (ENDERT 881); Komering Oeloe Sh. 80 m (GRASHOFF no. 574); Rawas (DUMAS no. 1563); ebenda Sh. 150 m (GRASHOFF no. 1061); Bosch Medak (BUURMAN VAN VREEDEN no. 76); Ogan Ilier (TEYSMANN no. 3947); Moeara Enim (TEYSMANN no. 4019); Lampongs Mangala (TEYSMANN no. 4357); Sawahloento (HAM); ebenda (Boschwezen no. 189); Vlakte Soengei Glawan Sh. 50 m (Exp. YZERMAN, KOORDERS no. 22321 β).

Kultiviert im botan. Garten zu Buitenzorg: IV A 101; IV A 94.

Nutzen: sehr geschätztes Bau- und Werkholz („Königsholz").

♂ **8. Fagraea sororia** J. J. SMITH nov. spec. Abb. 5 Fig. 1—3 [1]).

?? *F. fragrans* SCHEFF. (non ROXB.) Flora 1869, 309. ??

Arbor altitudine 25—40 m. Ramuli cylindracei; folia longe petiolata, cinereo-viridula, glabra, ovata, elliptica interdum obovata, apice acuta vel acutissima, basi in petiolum decurrentia, coriacea, longitudine 6—10 cm, latitudine 2—4 cm, in sicco costa media supra plana, in pagina dorsali prominente, nervis transversalibus utrinque obsoletis. Petioli 2—3 cm longi, basi foliorum decurrente angustissime marginati, vagina interpetiolari annulari, truncata. Corymbi longe pedunculati, e foliorum axillis superioribus erecto-patentes, trichotomi. Pedicelli 4—5 mm longi, basi bibracteolati. Bracteae parvae, oppositae, squamiformes. Calyx parvus, campanulatus, 2 mm longus, quincuncialis, quinis laciniis rotundatis, margine membranaceo angusto, corolla subflava, infundibuliformis, limbo quinquepartito; tubo 8 mm longo, faucem versus ampliato; laciniis ovatis, margine undulatis, patentibus, 5 mm longis, 3 mm latis. Stamina quinque, in parte summa tubi inserta, filamentis filiformibus, 21 mm longis, aequilongis, longissime exsertis, basi bifidis. Pistillum 19 mm longum. Stigma depresso capitatum. Baccae aurantiacae, globosae, in vertice basi styli mucronatae, magnitudine fructus piperis.

[1]) Standortsverhältnisse, die mir erst in allerletzter Zeit zur Kenntnis gekommen sind, lassen es mir sehr zweifelhaft erscheinen, ob es sich bei dieser Art wirklich um eine neue Spezies handelt. Die Eingeborenennamen für *F. fragrans* tembesu rawang und für *F. sororia* tembesu talang wiesen auf diese Verhältenisse (rawang-Morast; talang-Rücken) hin. Da im südlichen Teil von Sumatra, wo beide Arten vorkommen, diese beiden Bodenformationen miteinander abwechseln, so ist es sehr wahrscheinlich, dass die ganz geringen morphologischen Verschiedenheiten der beiden Arten durch die örtlichen Verhältnisse bedingt sind und daher *F. sororia* nur eine auf trockenerem Boden wachsende *F. fragrans* ist. (Nachtrag bei der Korrektur).

Abb. 5. Fagraea sororia; Fig. 1 blühender Zweig; Fig. 2 Einzelblüten; Fig. 3 Zweig mit Früchten.

Sumatra: Palembang, Banjoeasin & Koeboestreken, Sh. 15—25 m (ENDERT no. 44 E 1P 515, no. 44 E 2P 706, no. 44 E 1P 429, 44 E 2P 673; GRASHOFF no. 664); Moeara Doea Sh. 250 m (GRASHOFF no. 400); Rawas Sh. 80—100 m (GRASHOFF no. 1060; DUMAS no. 1550); Palembang (BUURMAN VAN VREEDEN no. 77); Moeara Enim (TEYSMANN no. 3796); Lampongs Kebang, (TEYSMANN no. 4210); Lampongs, Tandj-Penang (BRUINSMA no. 12); Sibak Mokko (?); Bengkalis (Houtvester Medan no. 19).

Diese Art steht der *F. fragrans* sehr nahe. Die Unterschiede liegen erstens in der Blattform, zweitens ist der Blattstiel bei *F. sororia* im Verhältnis zur Grösse des Blattes länger und zarter; ferner sind hier die Blätter flach, während sie bei *F. fragrans* gewölbt sind; auch ist bei *F. sororia* die Spitze des Blattes länger. Auch haben die Blätter weniger Seitennerven und die Zwischenräume zwischen diesen sind grösser. Die Blüten sind bei *F. sororia* etwas, allerdings unwesentlich kleiner; der Blütenbau ist bei beiden Arten gleich. Die Frucht bei *F. sororia* ist nahezu kugelig; der Höhendurchmesser ist kürzer als der Querdurchmesser; bei *F. fragrans* ist die Frucht etwas in die Länge gezogen.

Baum von 25 – 40 m Höhe, selten mit geradem Stamm,; Stamm rund, bis zu 1 m im Durchmesser, bisweilen auch dicker, ohne Bretterwurzeln. Stamm überall mit Auswüchsen und Knorren, reich verzweigte aber nicht breite Krone, Rinde dunkel, tief der Länge nach gefurcht; Furchen schraubenförmig um den Stamm verlaufend; nicht abschilfernd. Blumenknospen anfangs dunkelgrün, später mehr gelbgrün; Blumenkrone, Filamente und Griffel heligelb, Kelch lichtgrün, Antheren und Stempel grün, Fruchtknoten gelb; junge Frucht licht grünbraun, reife Frucht orangegelb, fleischig; Griffelrest gelb; Frucht geruchlos, kahl, süsslich, mehlig. Samen braun. Blüten wohlriechend.

Scheint auf die südliche Hälfte Sumatras beschränkt zu sein, wo diese Art im Wald auf trockenem Boden nicht allzu häufig vorkommt; bisweilen wird sie auch als Schattenbaum längs Wegen gepflanzt. Blütezeit Mai; Fruchtzeit Oktober.

9. Fagraea crenulata MAING. CLARKE in HOOK. Fl. Brit. Ind. IV, 83; KING & GAMBLE Jour. As. Soc. Beng. 74 (1908), 610.

Baum mit dicken Ästen, kleinen Bretterwurzeln und breiter Krone; stark ausgeprägte Blattnarben. Blätter gross, lederig, gegenständig, mit fein gelapptem Rand, breit-rund-verkehrt-eiförmig, oft fast kreisförmig, am Blattstiel mit breitem Rand herablaufend und in die Nebenblätter übergehend, bis 30 cm lang und bis 20 cm breit. Mittelnerv beiderseits sichtbar, auf der Unterseite hervortretend, Seitennerven 5 – 6 Paare, beiderseits deutlich sichtbar. Nebenblätter am Grunde der Blätter nach abwärts gebogene Lappen bildend, Stengel umfassend. Blütenstand mehrfach trichotom verzweigtes Pleiochasium, meist endständig, doch oft auch achselständig; letzte Verzweigungen je drei Blüten tragend; an der Basis aller Verzweigungen je zwei Vorblätter. Blüte gestielt, ungefähr in der Mitte des Blütenstiels 2 transversale Vorblätter (der Mittelblüte der letzten Teilinfloreszenzen fehlen diese). Kelch bauchig, quincuncial, tief fünflappig, ungefähr 7 mm lang, Lappen fast bis zum Grunde eingeschnitten, breit, oben spitzbogig zulaufend oder auch abgerundet, mit

häutigem Rand. Blumenkrone trichterförmig, fünflappig, hellgelb, $3^1/_3$ cm lang, Röhre im untern Teile eng, dann plötzlich becherförmig erweitert, 2 cm lang, Lappen $1^1/_2$ cm lang, oben abgerundet, am Rande gewellt, Staubblätter in der Mitte der Röhre befestigt, fädlich, $2^1/_2$ cm lang, aus der Röhre hervorragend; Antheren länglich, $^1/_2$ cm lang, am Rücken befestigt, an der Basis tief gespalten; Griffel 3 cm lang, aus der Röhre hervorragend, Narbe flach, gewölbt, in der Mitte vertieft; Frucht länglich-eiförmig, ungefähr $2^1/_2$ cm lang, mit Griffelrest an der Spitze; Samen zahlreich, klein, braun.

Borneo: Soengei Bakambat bei Kapoeas (Abar bin Adam no. 2141); Laboeanen bei Bandjermasin (DELMAAR no. 1128).

Sumatra: Bengkalis, Djalan djil Sh. 4 m (BEGUIN no. 362); Bengkalis Sh. 1—5 m (BRUINIER no. 68); N. Serdang bei Rantan-Pandjang in und nahe bei den Sümpfen Sh. 1—4 m (LÖRZING no. 3667); Atjeh, Insel Wai bei Balokan Sh. 10 m (KOORDERS no. 10643 β).

Nutzen: Liefert sehr gutes Holz, das als Bau- und Brennholz Verwendung findet.

10. **Fagraea fastigiata** BL. Rumphia II, 30, tab. 74, fig. 1 A & B; MIQ. Fl. Ned. Ind. II, 369.

Epiphyt oder Kletterpflanze, an den Internodien knorpelige Leisten, wodurch die Äste kantig erscheinen; Blattfläche am Stiel als Rand herablaufend. Blüten gestielt; Kelch quincuncial, fünflappig, Lappen in der Knospenlage sich kuppelförmig überdeckend und gedreht; Frucht länglich-eiförmig oder kugelig-eiförmig, Länge 6 cm, an der Spitze Griffelrest.

Celebes: Lokka Bonthain (TEYSMANN no. 13665); Boeloe Ballea b. Bonthain Sh. 1800—2000 m (BÜNNEMEIJER no. 12294, 12156, 12100).

Java: Res. Banjoemas: Prigombo Sh. 700—1000 m (KOORDERS no. 4329 β); Res. Besoeki Pantjoer Sh. 1000 m (KOORDERS no. 14520 β); Res. Bantan: Bodjongmanik (KOORDERS no. 40860 β); Res. Preanger: Tjidadap bei Tjibeber Sh. 850 m (BACKER no. 22455,); Res. Semarang: Pesawahan Sh. 600 m (DOCTERS V. LEEUWEN no. 2893).

Molucken: Insel Ceram, zwischen Riring und Manoesa Manoewe Sh. 500—800 m, Urwald (Rutten no 2187).

Insel Simaloer (ACHMAD no. 154).

Malay. Archipel: ohne sonstige Angaben (TEYSMANN? no. 5839).

Nutzen: Bauholz.

11. **Fagraea obovata** WALL. Fl. Ind. ed CAREY II, 33. — *F. obovata* BL. Bijdr. 1021.—*F. oborata-javana* BL. Rumphia II, 29, tab. 75; MIQ. Ann. Mus. bot. Lugd. Bat. II, 217.—*F. vaginata* KING & GAMBLE Jour. As. Soc. Beng. 74, 611.

Epiphyt, Kletterpflanze, aber auch Strauch, bisweilen als Baum vorkommend. Blätter lang gestielt länglich-verkehrt-eiförmig, oben abgerundet oder zugespitzt, an der Basis keilförmig. Blattstiel 2—3 cm lang, mit deutlichem, ungefähr 3 mm breiten und bis 1 cm langen, oben zugespitzten, abstehenden Stipulargebilden. Blüten wohlriechend.

Diese Art kommt im allgemeinen an höher gelegenen Orten vor und steigt selten unter 1000 m herunter.

Java: allgemein verbreitet.

Sumatra: G. Talamau (BÜNNEMEIJER no. 749 b); G. Koerintji Sh. 1800 — 2200 m (BÜNNEMEIJER no. 9467, 9731, 9175, 10508); Sibolangit, Boekit Kioear (MD. NUR no. 7213); Sibolangit Sh. 500 m (LÖRZING no. 4282); ssö. Sibajak Sh. 1500 m (LÖRZING no. 6009); N. Sibajak im alpinen Urwald, Sh. ± 1900 m (LÖRZING no. 8294); Koerintji, Soengei Koembang, Sh. 1400 m (JACOBSON no. 2460); bei G. Malintang Sh. 1250 m (BÜNNEMEIJER no. 3770); Merapi Sh. 1200 m (BÜNNEMEIJER no. 4950); bei Teüngkeh, Karohochebene ± 1400 m (LÖRZING no. 8524).

Nutzen: Das fein zerriebene Blatt wird von den Eingeborenen als Mittel gegen Fieber und Kopfschmerzen gebraucht.

12. **Fagraea carnosa** JACK Mal. Misc. II, n. 7, 81; MIQ. Fl. Ned. Ind. II, 374. — *F. monantha* MIQ. Fl. Ned. Ind. II, 373; MIQ. Ann. Mus. bot. Lugd. Bat. II, 218; JACK Flora 1869, 308; SCHEFFER in Natuurk. Tijdschr. Ned. Ind. XXXI, 21.

Kletterpflanze, Blätter gegenständig, ganzrandig, kurz gestielt, breit oval oder oft verkehrt-eiförmig, mit kurzer Spitze, an der Basis abgerundet oder auch breit-keilförmig, bis 14 cm lang und bis $8^1/_2$ cm breit; Mittelrippe beiderseits deutlich, auf der Unterseite hervortretend, Seitennerven nicht sichtbar, am Rande zurückgebogen; auch im trockenen Zustand Seitennerven unsichtbar, Rand eingerollt. Stets einblütig, Blüte endständig, sitzend, an der Basis des Kelches 2 kreuzweis stehende Paare von Vorblättern, Kelch tief fünflappig, ungefähr 3 cm lang, Lappen oval, so lang als die Röhre. Blumenkrone weiss, fest, trompetenförmig, fünflappig, Röhre bis 12 cm lang, zylindrisch oder nur wenig nach oben erweitert, Lappen $3^1/_2$—4 cm lang, länglich-oval, zurückgebogen. Staubblätter ungefähr 2 cm unterhalb des Schlundes entspringend, Filamente kurz, fadenförmig, Anthere $1^1/_2$ cm lang, schmal, Antherenhälften oben und unten auseinander weichend. Griffel ungefähr 13 cm lang, aus der Röhre hervorragend, Narbe knopförmig. Frucht schlank ellipsoidisch, oben spitz zulaufend mit derbem Griffelrest, Kelch stark vergrössert der Frucht anliegend; Samen nicht sehr zahlreich, klein, im Fruchtfleisch eingebettet.

Sumatra: an der Küste von Siboga (TEYSMANN); bei Benkoelen (JACK).

Kultiviert im botan. Gart. zu Buitenzorg: XVI A 45 & 45a.

13. **Fagraea bracteosa** nov. spec. Abb. 6 und Abb. 7 Fig. 1—6

Ramuli angulati; folia opposita, glabra, coriacea, integerrima, elliptica, apice breviter acuta, basi cuneata, petiolata, circa 21 cm longa et 8—10 cm lata, costa media supra prominente, in sicco nervis transversis utrinque obsoletis; petioli 2—3 cm longi, firmi, stipulis $^3/_4$ cm longis, a ramulo distantibus, margine membranaceo, valde simillibus stipulis *F. oboratae*. Inflorescentia terminalis, triflora, interdum etiam in axillis duorum foliorum supremorum flores singuli. Flores pedunculati, (pedunculi 1—$1^1/_2$ cm longi), 2 bracteis transversalibus, angustis, 1—$^1/_2$ cm longis, acutis, margine membranaceo lato; calyx quinquepartitus, quincuncialis, laciniis 2—$2^1/_2$ cm longis,

Abb. 6. Fagraea bracteosa.

rotundatis, margine membranaceo. Corolla tubaeformis, 15—18 cm longa, quinque laciniis; tubo faucem versus ampliato vel fere cylindraceo, 9 cm longo, laciniis ovalibus, late rotundatis, 3 cm longis; staminibus circa $2^1/_2$ cm longis, in tubi quarta parte suprema affixis, vix e tubo exsertis, filamentis basi geniculatis, apicem versus tenuioribus, antheris ellipticis, in dorso medio affixis, basi bipartitis; stylus circa 10 cm longus; stigma orbiculare. Fructus mihi ignotus.

Celebes: G. Sajo (Exp. v. VUUREN, RACHMAD No. 723).

Philippinen: Palawan (MERRILL no. 7254).

Diese Art ist verschiedenen *Fagraea*-Arten, wie *F. auriculata*, *borneensis*, *euneura*, *carnosa* ähnlich, lässt sich aber doch wieder von jeder einzelnen leicht unterscheiden. Von *F. auriculata* unterscheidet sie sich durch die Blüten, die bei jener grösser und derber sind und breit trichterige Form haben, während die Blumenkronröhre bei *F. bracteosa* nur wenig

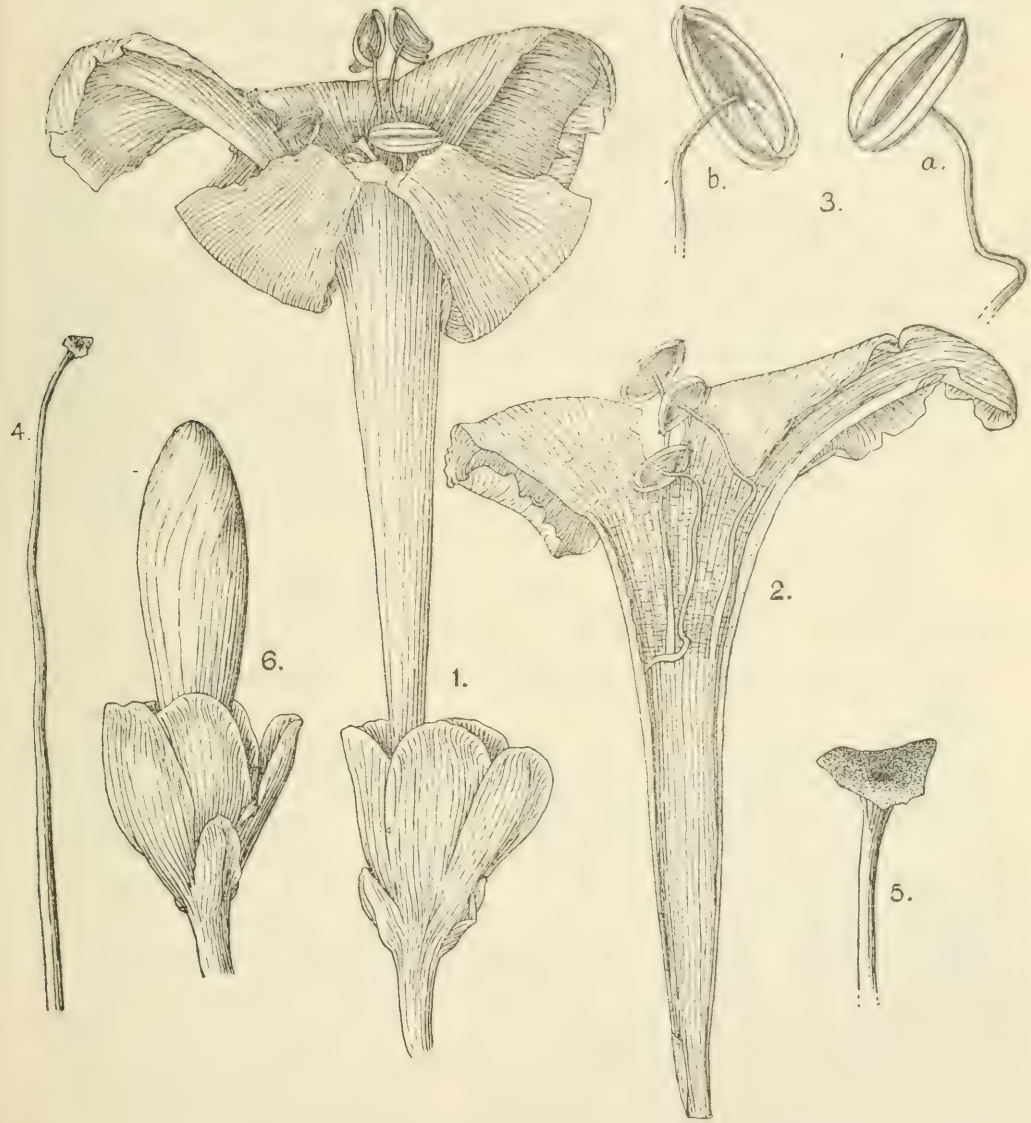

Abb. 7. Fagraea bracteosa. Fig. 1 Einzelblüte; Fig. 2 Blüte im Längsschnitt; Fig. 3a Anthere von oben; 3b Anthere von unten; Fig. 4 Griffel; Fig. 5 Narbe; Fig. 6 Knospe.

nach oben verbreitert oder fast zylindrisch ist; auch fehlen ihr am Blattstielgrund die Öhrchen. Mit *F. borneensis* besteht wohl eine gewisse Ähnlichkeit in der Form der Blüten, doch zeigt sich auch hier der Unterschied im Mangel der ohrförmigen Nebenblätter. Von *F. euneura* wiederum, mit der sie in der Blattform Übereinstimmung zeigt, ist sie durch die Gestalt der Blüten verschieden, die bei *F. euneura* so wie bei *F. auriculata* breittrichterig aber kleiner sind; auch in der Art der Ausbildung der Stipulargebilde zeigen sich Verschiedenheiten. Von *F. carnosa* schliesslich unter-

scheidet sie sich durch den Blütenstand, da *F. carnosa* stets einblütig und die Blüte sitzend ist. Die Blüten sind sonst wohl sehr ähnlich. Aber auch in den Blättern zeigen sich Unterschiede. Sie sind bei *F. carnosa* kleiner, dicker und zeigen weder auf der Oberseite noch auf der Unterseite die Seitennerven, die, wenn auch nicht auffallend, so doch immer ohne weiters bei *F. bracteosa* zu sehen sind.

14. **Fagraea tubulosa** BL. Mus. bot. Lugd. Bat. I, 167; MIQ. Fl. Ned. Ind. II, 373; KING & GAMBLE in Jour. As. Soc, Beng. '74, 604.

Liane, Blätter mit langer Träufelspitze, Seitennerven an trockenen Blättern kaum sichtbar. Blütenstand 5 blütig, endständig, mit zwei lanzettlichen Hochblättern. Blüte sitzend mit 2 kleinen Vorblättern, Kelch ungefähr 1 cm lang, 5 lappig, quincuncial, Lappen so lang als der verwachsene Teil. Korolle trichterig, mit sehr langer dünner Röhre; Röhre zylindrisch, 8 cm lang, Lappen ungefähr 1 cm lang, zurückgebogen. Staubblätter nahe dem oberen Ende der Röhre angewachsen, aus dieser kaum hervorragend, Filamente sehr kurz, fädlich, Antherenhälften an der Basis auseinanderweichend, Griffel dünn, 9 cm lang, Narbe knopfförmig.

Sumatra: ohne nähere Angaben (?); (KORTHALS); Moeara Enim (TEYSMANN no. 3990); Agam, Brani Sh, 900 m (BÜNNEMEIJER no. 3115).

15. **Fagraea borneensis** SCHEFF. in Natuurk. Tijdschr. voor Ned. Ind. XXXI, 21.

Baum mit kantigen Zweigen; Blätter länglich-verkehrt-eiförmig, an der Basis des Blattstiels 2 nierenförmige, abstehende oder zurückgebogene Nebenblätter. Blütenstand endständig, 3 blütig, oft in den Achseln des darunter stehenden Blattpaares noch je eine Blüte. Lappen der Korolle in der Knospenlage rechts gedreht, der Rand an der Spitze gewellt und propellerartig zurückgebogen. Blumenkrone trompetenförmig. Farbe der frisch geöffneten Blüte: Lappen innen im oberen Teil weiss, unten hellgrün bis grün, aussen halb weiss, halb hellgrün und zwar ist der in der Knospenlage gedeckte Teil weiss, Röhre innen grün mit dunkelgrünen Längsstreifen, aussen hellgrün; das Grün sich bald in Gelb verfärbend. Frucht schlank eiförmig, an der Spitze kurzer Griffelrest, 7 cm lang, breitester Querdurchmesser 4 cm, kantig, mit pergamentartiger, weisser Haut, zweifächerig, vielsamig; Fruchtfleisch einer frisch angeschnittenen Frucht rasch orangegelb werdend. Blüte stark jasminartig duftend.

Borneo: von LOBB bei Sarawak im nördl. Teil der Insel gesammelt. Kultiviert im botan. Garten zu Buitenzorg: X G 30 & 30a; XVI A 34 & 34a.

16. **Fagraea auriculata** JACK Mal. Misc. II, 82; WALLICH Fl. Ind. ed. CAREY II, 34; BLUME Rumphia II, 26, tab. 72; MIQ. Fl. Ned. Ind. II, 371. — *F. epiphytica* ELM. Leafl. Phil. Bot. VIII, 2743. — *Willughbeia auriculata* SPRENG. Syst. veg. cur. post. 71.

Epiphyt, bisweilen strauch- oder auch baumartig; Zweige und Äste kantig, mit scharfen Leisten an den Internodien. Blattnarben sehr ausgeprägt, dicht gedrängt. Blätter dicklederig, gestielt, länglich-oval, Mittelnerv auf der

Blattunterseite orangegelb; an der Basis des kräftigen Blattstieles 2 ohrförmige Nebenblätter. Diese sind halbmondförmig, gewölbt, unterseits hohl, zurückgebogen, bei jungen Blättern an den Stengel angelegt. Blütenstand endständig, meist 3 blütig, selten einblütig, bisweilen 5 blütig. Blüte gross, mit 2 transversalen Vorblättern, die Gipfelblüte oft mit vier, in Paaren alternierenden Vorblättern. Kelch tief fünflappig. Korolle breit trichterig, tief fünflappig; Röhre oben bauchig erweitert, ungefähr 7 cm lang; Lappen abstehend, ungefähr 6 cm lang, in der Knospenlage rechtsgedreht [1]). Staubblätter in der Mitte der Röhre befestigt, aus dem Schlunde hervorragend; Filamente blass-rötlichviolett, am Grunde knieförmig gebogen; Antheren oval, über $1^1/_2$ cm lang, in der Mitte des Rückens befestigt, gelblich; Griffel kräftig, grün, mit grosser, flacher Narbe. Frucht gross, lang-eiförmig, mit pergamentartiger Haut, ungefähr 7—8 cm lang und im unteren Teil 4 cm im Durchmesser, an der Spitze mit Griffelrest.

Bali: G. Pala, Sh. 560 m (Exp. R. MAIER, SARIP no. 268).

Banka: Djeboes (TEYSMANN); Blinjoe (TEYSMANN).

Billiton: Angkerek (VORDERMAN); Tandj. Pandan (TEYSMANN).

Borneo: Pontianak (TEYSMANN).

Java: Res. Banjoemas: Noesa Kembangan (KOORDERS no. 24756 β); ebenda bei Tjimiring Sh. 150—200 m (v. STRAELEN no. 31; DEN BERGER no. 295); Mindangan Sh. 800 m (KOORDERS no. 34073 β); Res. Bantam: Danoe, Sh. 100 m (KOORDERS no. 40499 β, 40472 β; 4323 β); G. Kantjana (KOORDERS no. 41416 β); G. Aseupan bei Bandjoewangi Sh. 300 m (BACKER no. 7109); zwischen Malingping und Panjoewoengan Sh. 5 m (BACKER no. 1467); Res. Batavia: bei Depok (KOORDERS no. 31000 β); Nirmala Sh. 1400 m (BACKER no. 10719); Desa Babakan bei Buitenzorg (HALLIER f.); Res. Besoeki: Pantjoer Sh. 1000 m (KOORDERS no. 14519 β, no. 14913 β, no. 21540 β); Res. Madioen: G. Wilis Sh. 1350 m (KOORDERS no. 34186 β; no. 4326 β; no. 29171 β; no. 4325 β); Res. Preanger: Naturmonument-Insel Noesa Gede Sh. 720 m (KOORDERS no. 47897 β, no. 47898 β); G. Semboeng, Rongga Sh. 1300 m (LÖRZING no 1249); Biwak Denoe, Tji Patoedjah Sh. 500—600 m (BACKER no. 9034); Tjadas Malang Sh. 1000 m (WINCKEL no. 179).

Philippinen: Mindanao, Cabadbaran (ELMER no. 13850).

Sumatra: bei Bantar-baroe Sh. 1000m (LÖRZING no. 5898); Banjoeasin & Koeboestreken Sh. 20 m (GRASHOFF no. 857); Mittelsumatra Sh. 30 m (Exp. YZERMANN, KOORDERS no. 22322), N. Sibajak im alpinen Urwald Sh. $\pm$ 1900 m (LÖRZING no. 8323).

Kultiviert im botan. Garten zu Buitenzorg: XVI A 38 & 38a; X G 18.

17. Fagraea imperialis MIQ. Fl. Ned. Ind. II, 372; MIQ. Ann. Mus. bot. Lugd. Bat. II, 216, tab. V—VI.

Kräftiger Strauch oder Baum; sowohl im Habitus des ganzen Baumes wie in der Gestaltung der Blüten sehr ähnlich der *F. auriculata*, jedoch in

[1]) BLUME spricht in Rumphia allerdings von . . . . in praefloratione sinistrorsum tortis . . . ; siehe hierüber die obenstehende Bemerkung in der Einleitung.

allen Dimensionen viel grösser. Dies drückt sich namentlich in der Blüte aus, die bei weitem grösser ist als bei *F. auriculata* und eine Länge von 25 cm hat; die Röhre ist 14 cm lang, oben 8 cm und unten 2 cm im Durchmesser und hat eine Dicke von ungefähr 8 mm. Die Filamente sind zum Teil mit der Röhre verwachsen und werden oberhalb der Mitte der Röhre frei; sie sind weiss. Antheren bleichgelb und nach der Entleerung des Pollens mit breitem, häutigem Rand. An den Internodien der jungen Zweige finden sich ebenso wie bei *F. auriculata* scharfkantige Leisten, die an ihrem oberen Ende unterhalb der Öhrchen mit einem knorpeligen Dorn enden, der an älteren Zweigen verholzt, hart und etwas nach abwärts gebogen ist. Die Blüten stehen endständig zu dreien, oft durch Ausfall einer Seitenblüte zu zweien, selten einzeln. Die Mittelblüte besitzt meist 3 Paare von Vorblättern. Der Kelch birgt reichlich milchig-trübes Wasser. Griffel 14 cm lang, von der Dicke eines Bleistiftes, an der Spitze fast rechtwinklig gebogen, weiss; Narbe flach scheibenförmig, 2 cm im Durchmesser, in der Mitte eingesenkt, am Rand abwärts gebogen, grün. Frucht länglich-eirund, ungefähr 12 cm lang, unten ungefähr 6 cm im Durchmesser.

Sumatra: West-Küste, Siboga an der Küste (TEYSMANN no. 999).
Kultiviert im botan. Garten zu Buitenzorg: X G 31a; IV A 124 & 124a.

18. **Fagraea cuneura** SCHEFF. in Flora 1869, 308; SCHEFF. in Natuurkund. Tijdschr. Ned. Ind. XXXI, 20.

Kräftiger Strauch oder Kletterpflanze, reich verästelt; junge Zweige mit kräftigen, abgerundeten Kanten. Oberseite der Blätter glänzend grün, Unterseite mattgrün, Mittelnerv auf der Blattunterseite grün (letzteres Merkmal ein guter Unterschied bei der Ähnlichkeit der Blätter mit denen von *F. auriculata*). An der Basis des Blattstieles zwei kleine, knorpelige Stipularhöcker. Blütenstand endständig, 3blütig. Blüte kräftig gestielt, mit 2 transversalen Vorblättern. Kelch grün, tief 5lappig; Lappen fast 2 cm lang mit häutigem Rand. Korolle breit trichterig, 5lappig, Röhre oben bauchig erweitert, 6 cm lang, Lappen 4 cm lang; innen weiss, aussen halb weiss, halb gelbgrün (wie bei *F. borneensis*), Röhre innen gelbgrün, aussen weisslich-grün. Blütenblätter in der Knospe grün. Staubblätter im oberen Viertel der Röhre angeheftet, zwischen den Lappen stehend, aus der Röhre hervorragend. Filamente an der Basis knieförmig gebogen, weiss; Antheren elliptisch, leicht gebogen, am Rücken befestigt. Griffel 6 cm lang, aus der Röhre ragend; Narbe flach, scheibenförmig, in der Mitte vertieft, Rand herabgebogen. Blüten geruchlos. Frucht kugelig, von der Grösse eines kleinen Apfels, an der Spitze Griffelrest, vielsamig.

Molucken: Halmaheira, bei Galela (TEYSMANN no. 7807).
Kultiviert im botan. Garten zu Buitenzorg: X G 27 & 27a.

19. **Fagraea litoralis** BL., Bijdr. 1021; BL. Rumphia II, 28, tab. 74; MIQ. Ann. Mus. bot. Lugd. Bat. II, 217. — *F. crassifolia* BL. Rumphia II, 31, tab. 78, fig 1; MIQ. Ann, Mus. bot. Lugd. Bat. II, 217. — *F. celebica* BL. Mus. bot. Lugd. Bat. I, 167. — *F. minor* RWDT. BL. Bijdr. 1021.

Es ist wohl das Beste, die beiden Arten *litoralis* und *crassifolia* zu vereinigen, da es unmöglich ist, wirklich tiefgehende Unterschiede zwischen beiden Arten zu finden. Die Blätter bei *F. crassifolia* sind vielleicht etwas derber und auch grösser, doch finden sich am selben Exemplar oft alle Übergänge in der Blattform von *litoralis* zu *crassifolia*. Die Blüten zeigen gar keine Verschiedenheiten. In der Blattform und Blattgrösse ist diese Art sehr variabel. Meist kommt sie als Liane vor.

Celebes: Tomohon Sh. 800 m, hier Epiphyt KOORDERS no. 17738 β).

Java: sehr allgemein, meist als Liane in Seehöhen zwischen 100 und 800 m.

Molucken: Insel Taliaboe, Tandj. Niuw (V. HULSTIJN no. 363); Ceram (TEYSMANN no. 1916; DE VRIESE et TEYSMANN).

Sumatra: westl. v. Bandarbaroe im Urwald, Sh. $\pm$ 900 m (LÖRZING no. 7348).

Kultiviert im botan. Garten zu Buitenzorg: X G 38; XVI A 32a; XVI A 37 & 37a; XVI A 43 & 43a; Z 147; Z 33; *Z* 37.

Unter *F. litoralis* möchte ich auch eine Pflanze von Bali einreihen, die im Buitenzorger Herbar nur in einem Exemplar vorhanden ist und sich in der Form der Blätter nicht von *F. litoralis* unterscheidet. Auch die Blüten gleichen denen von *F. litoralis* vollkommen und sind vielleicht nur wenig kleiner. Der einzige Unterschied besteht in der reicheren Infloreszenz. Es ist möglich, dass es sich um einen ausnahmsweise reichen Blütenstand handelt. Auch diese Pflanze ist eine Kletterpflanze.

Bali: G. Pala, Sh. 490 m (Exp. MAIER, SARIP no. 251).

20. Fagraea amboinensis BL. Mus. bot. Lugd. Bat. I, 166.— *F. litoralis* BL. var. *amboinensis* BL. Rumphia II, 28.

Steht *F. litoralis* nahe, kann aber doch wegen der länglichen Früchte und der eiförmigen Blätter als eigene Art aufrecht erhalten bleiben. Blüten habe ich nicht gesehen.

Amboina (C. B. ROBINSON „Plantae Rumphianae amboinenses" 159).

21. Fagraea lanceolata BL. Bijdr. 1021; BL. Rumphia II, 31, tab. 77; MIQ. Ann. Mus. bot. Lugd. Bat. II, 218; KING & GAMBLE in Jour. As. Soc. Beng 74. 607 mit Ausschluss MIQ. Fl. Ned. Ind. II. 376, da diese *F. lanceolata* WALL. gleich *F. Wallichiana* Benth. ist.

Auch diese Form steht *F. litoralis* sehr nahe. Die Blätter sind aber viel schlanker und lanzettförmig. Im Übrigen ist auch hier die Artabgrenzung nicht leicht.

Java: Res. Bantam: Kotta Pandeglang Sh. 250 m (KOORDERS no. 4344 β); Res. Banjoemas: Madjenang Sh. 30 m (BACKER no. 18686); Res. Batavia: G. Salak Sh. 600—1000 m (BLUME; KOORDERS no. 24157 β); Res. Preanger: Tjibeureum bei Bandoeng Sh. 700 m (SCHOLTE no. 2355); Tjadas-Malang Sh. 1000 m (BAKHUIZEN V. D. BRINK no. 2926); Takoka, Tjandjoer Sh. 1200 m (KOORDERS no. 25545 β, no. 33316 β, no. 33339 β); Bandoeng Tjigenteng, Sh. 1460 m (KOORDERS no. 26247 β); Pangentjongan, Telagabodas bei

Garoet Sh 1500 m (KOORDERS no. 4322 β, no. 10114 β); Res Kedoe: G. Andong Sh. 1200 m (KOORDERS no. 36611 β); ohne nähere Angabe (FORBES no. 489 und no. 563a).

Sumatra: West-Küste, G. Malintang, Sh. 1100 m (BÜNNEMEIJER no 3610).

Kultiviert im botan. Garten zu Buitenzorg: X G 26; X G 28a; XVI A 32; XVI A 42; XVI A 46.

22. Fagraea lutea nov. spec. Abb. 8. Fig. 1—3.

Frutex vel planta scandens, ramulis glabris, teretibus, cortice rubicundo vel rubelo. Folia opposita, petiolata, integerrima, coriacea, lato-ovalia, basi rotundata vel celeriter in petiolum transeuntia, apice plus minus longe acuta vel interdum obtusa, usque 10 cm longa, 5—6 cm lata, in sicco costa media utrinque perspicua, nervis transversis non vel minime conspicuis; Petiolus 2 cm longus, basi stipulare margine angusto. Corymbus 7—9-florus, trichotomus, in brevibus ramulis lateralibus terminalis vel raro in ramulis terminalis. Flores pedicellati, lutei, in medio pedicello 2 bracteis transversalibus. Calyx quinquepartitus, quincuncialis, 1 cm longus, laciniis aequalibus, rotundatis, margine membranaceo. Corolla infundibuliformis, quinquepartita; tubus faucem versus ampliatus, 3 cm longus, ovalis, 1,2 cm cm latae; stamina in superiore parte tertia affixa; stylus 4 cm longus, curvatus; stigma orbiculatum. Fructus globosus, apice brevi styli basi mucronatus, nitidus, diametro circiter 2 cm, viridus.

Sumatra: Eiland Simaloer, bei Amabahan, Hügelrücken bei Loegoe Boeaja (PFEIFFER no. 38); ohne nähere Ortsangabe (ACHMAD no. 349 no. 848, no. 1058). Wald, Sumpf, verstreut, selten. Blütezeit: März.

Diese Art ähnelt zum Teil der *F. litoralis*, unterscheidet sich aber von ihr durch die dünneren Blätter und deren Form, vor allem aber durch den Blütenstand. Dieser steht meist an Enden von Kurztrieben, die oft sehr kurz und kaum beblättert aus den Achseln von Blättern hervorgehen, sodass der Anschein eines seitenständigen Blütenstandes erweckt wird. Doch kommen auch endständige Infloreszenzen an Langtrieben vor. Die Blütenstände sind auch reichblütiger als bei *F. litoralis* und die Blüten kleiner als bei dieser Art.

23. Fagraea acuminatissima MERRILL in Journ. Straits Branch R. A. Soc. no. 77, (1917), 232. Abb. 9 Fig. 1 & 2.

Die Blätter sind bei dem Originalmaterial von MERRIL wohl länglich-elliptisch, doch finden sich unter den mir vorliegenden Pflanzen auch solche mit breit-elliptischen und verkehrteiförmigen Blättern. Sie sind dick-lederig und zeigen beiderseits deutlich die Mittelrippe, die auf der Unterseite vorspringt, dagegen sind die Seitennerven vollkommen unsichtbar. Länge 15—20 cm, Breite 4,5—10 cm. Der Blattstiel ist fest, ungefähr 2 cm lang und an der Basis dreieckig verbreitert. An getrockneten Blättern ist der Blattrand leicht nach unten eingeschlagen. In der Regel ist die Infloreszenz 5blütig, seltener 3blütig. Die Masse an den von mir untersuchten Blüten sind etwas grösser als die bei MERRIL angegebenen: Kelch 12 mm lang, Kelchlappen 6 mm lang, Rand häutig; Korolle trompetenförmig; Röhre

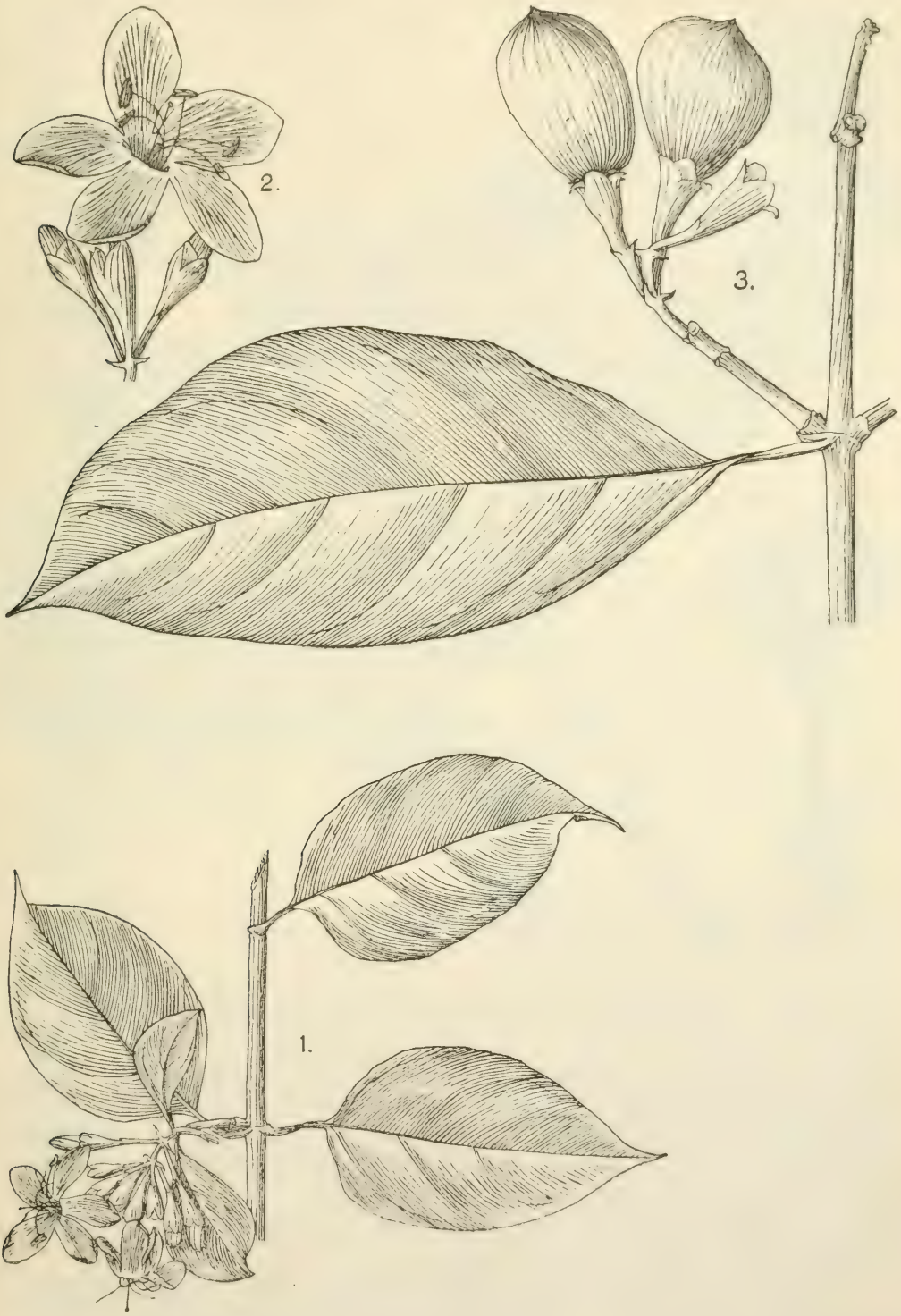

Abb. 8. Fagraea lutea. Fig. 1 blühender Zweig; Fig. 2 Einzelblüte, Fig. 3 Zweig mit Früchten.

Abb. 9. Fagraea acuminatissima; Fig. 1 blühender Zweig; Fig. 2. Einzelblüte.

gegen den Schlund allmählich erweitert, 4 cm lang, Lappen 2 cm lang, oval, 12 mm breit, der Rand gewellt. Staubfäden 5, im oberen Viertel der Röhre befestigt, fadenförmig, an der Basis gekniet, 3 cm lang. Antheren am Rücken befestigt, oval, an der Basis gespalten, zurückgebogen. Griffel $4^1/_2$ cm lang, fest; Narbe scheibenförmig, gewölbt.

Banka: Soengei liat, G. Maras Sh. 20 m (BÜNNEMEIJER no. 1834); Mont Boei (TEYSMANN).

Borneo: Poentianak (TEYSMANN); Sarawak (Nat. collector no. 686).

Riouw-Archipel: Poeloe Toedjoeh, Penarik Sh. 20 m (BÜNNEMEIJER no. 6100).

Malay. Halbinsel: Penang (MD. HANIFF no. 3755).

24. Fagraea annulata HIERN in Nova Guinea VIII, 202. – Abb. 10. Fig. 1 & 2.

Abb. 10. Fagraea annulata, Fig. 1 Blüte; Fig. 2 dieselbe im Längsschnitt.

Neu Guinea: bei Zandvoort und Sabangkamp (VERSTEEG no. 1237).

Die Blüten haben ungefähr die Grösse derer von *F. obovata*. Durch die Blattform, namentlich aber durch den kräftig ausgebildeten Ring in der Röhre deutlich von allen anderen Arten unterschieden.

Wenig bekannte Arten.

Fagraea Kimangu BL. Mus. bot. Lugd. Bat. I, 173;

Fagraea picrophlaea BL. Rumphia II, 36;

Fagraea rostrata BL. Rumphia II, 31, tab. 76, fig. 2, vielleicht *F. lanceolata* BL.

Fagraea ternatana MIQ. Ann. Mus. bot. Lugd. Bat. II, 217.

Kurz vor Abschluss des Manuskripts erhielt ich einige fruchttragende Zweige einer *Fagraea* — Art von Ternate. Sie stimmen vollkommen mit der Beschreibung für *F. ternatana* MIQUEL überein. Da mir Blüten fehlen und auch das Originalmaterial nicht zugänglich ist, führe ich die Art hier an.

Die Blätter ähneln denen von *F. obovata*; jedoch sind die Stipulargebilde nicht so kräftig ausgebildet. Die Blätter sind dick lederartig und zeigen im trockenen Zustand keine Seitennerven. Die Blüten stehen zu dreien oder fünfen. Die Brakteen an den Blütenstielen sind dreieckig, zugespitzt, ungefähr $^1/_2$ cm lang. Die Frucht ist kugelig und trägt einen kurzen, flach abgestumpften Griffelrest. Nach BEGUIN mehr oder weniger hoher Baum oder Liane (?) mit wenigen, dicken Stelzenwurzeln; Stamm stets gekrümmt und eckig. Krone breit; Rinde dunkelbraun und abschilfernd. Kernholz lichtgelb, hart; Splintholz lichter als der Kern, hart Blätter und Zweige kahl; Blätter dunkelgrün, oben glänzend; Blüte creme-weiss; Frucht grün.

Ternate: Nord-Toramadiahi Sh. 1000—1300 m (BEGUIN no. 1456, no. 1520); (TEYSMANN und DE VRIESE nach MIQUEL).

Fagraea tetragona SP. Linnaea XV, 326;

Fagraea truncata MIQ. Fl. Ned. Ind. II, 376, vielleicht *F. sumatrana* MIQ.

BUDDLEIACEAE.

Diese Familie wird von vielen Systematikern mit der vorhergehenden Familie vereinigt und in diese als eigene Gruppe eingereiht. Die Verschiedenheiten, die auch WETTSTEIN veranlasst haben, sie als eigene Familie von den *Loganiaceen* abzutrennen, sind jedoch so tiefgehende, dass die Lostrennung ganz gerechtfertigt erscheint. Die *Buddleiaceen* sind vor allem durch das Fehlen des intraxylären Phloems, das alle *Loganiaceen* besitzen, sowie durch den Besitz von Drüsenhaaren, die den *Loganiaceen* fehlen, ausgezeichnet. Die Blüten sind vierzählig, die Blätter meist gezähnt oder gelappt. [1])

Von dieser Familie ist eine einzige Gattung in Niederländisch-Indien vertreten.

BUDDLEIA L.

Gen. n. 140. SOLEREDER in E. & P. IV/2, 46.

BLUME unterscheidet vier Arten und auch MIQUEL führt noch drei verschiedene Arten an, die aber wohl alle zu einer Art zusammengezogen werden können, wie es auch KOORDERS und VALETON in ihren Boomsoorten op Java machen. Allein diese beiden Autoren unterscheiden wieder drei verschiedene Varietäten der einen Art *B. asiatica*. Bei der Durchsicht des mir zur Verfügung stehenden Materials konnte ich mich auch mit dieser Anhäufung recht zweifelhafter Varietäten nicht einverstanden erklären. Ich habe vielmehr den Eindruck, dass diese Art sich je nach dem Standort im Habitus und in der Behaarung verändert.

Buddleia asiatica LOUR. Fl. Coch. 72; MIQ Fl. Ned Ind. II, 363; KOORDERS & VALETON Boomsoorten op Java, Bijdr. IX, (1903), 89 und Syn.

Celebes: G. Papandangan (Exp. v. VUUREN, RACHMAT no. 396); Sapoetan-Gebirge Sh. 1300 m (KOORDERS no. 17730 β); Urwald bei Biwak Pinamorongan nächst Kajoewatoe Sh. 500 m (KOORDERS no. 17731 β); Pinamorongan-Gebirge Sh 500 (KOORDERS no. 17732 β); Weg von Menado nach Tomohon Sh. 700–800 (KOORDERS no. 17733 β); b. Bonthain Sh. 1500 m (BÜNNEMEIJER no. 12106).

Java: Res. Batavia: Nordabhang d. G. Salak oberhalb Waroengloa Sh. 1000 m (BACKER no. 22001); Schlucht des Tjiapoes oberhalb Waroengloa Sh. 600 m (BACKER no. 2310); im Geröll des Tjiapoes (HALLIER); Res. Besoeki: Pradjekan Sh. 60 m (BACKER no. 24530); Pantjoer Sh. 1500 m (KOORDERS no. 32506 β, no. 28593 β); Idjen-Hochfläche bei Belawan Sh. 1000 m (BACKER no. 25168); Kawah Idjen Sh. 2000 m (KOORDERS no. 43177 β,); Jang-Hochfläche Sh. 2300 m (BACKER no. 9634); Nordostabhang des Jangge-

[1]) Die Berechtigung der Lostrennung der *Buddleiaceen* von den *Loganiaceen* findet ihre Bestätigung in den embryologischen Untersuchungen, welche in jüngster Zeit von K. V. O. DAHLGREEN (Die Embryologie der Loganiazeen-Gattung Spigelia; Svensk Botanisk Tidskrift Bd. 16, H. 1, (1922), 77–87, angestellt wurden. (Nachtrag bei der Korrektur.)

birges bei Banderan Sh. 2300 m (BACKER no. 9550); Jang-Hochfläche, Argopoero Sh. 2100—3020 m (KOORDERS no. 43662 β, no. 43641 β); Res. Cheribon: Ostabhang G. Tjerimai Sh. 2900 m (BACKER no. 5077); Res. Kediri: Ostabhang G. Wilis Sh. 1700 m (BACKER no 11542); Res. Kedoe: G. Sendoro Sh. 1405 m (KOORDERS no. 11329 β); G. Dieng Sh. 2550 m (KOORDERS no. 11220 β); Res. Madioen: G. Lawoe Sh. 1200 m (JACOBSON); zwischen Kalak und Patjitan Sh. 150—200 m (BACKER no. 2877); G. Pitjis (KOORDERS no. 29297 β); Poedok Sh. 1750 m (KOORDERS no. 4343 β); Res. Pasoeroean: G. Lomongan (KOORDERS no. 24100 β); N. Sendoro bei Sibadjak Sh. 1650 m (LÖRZING no. 156); Tengger-Gebirge Sh. 1600—2000 m (MOUSSET no. 843; KOBUS no. 127; KOORDERS no. 37660 β); Ngadisari, Tengger Sh. 2200 m (KOORDERS no. 37657 β, no. 37659 β); G. Batok Sh. 2200 m (KOORDERS no. 37658 β,); G. Ardjoeno Sh. 2400 m (KOORDERS no. 38142 β); Weg Lalidjiwo-Tretes Sh. 800 m (BREMEKAMP; KOORDERS no. 43718 β Sh. 1000—1200 m); bei Lalidjiwo Sh. 2500 m (ARENS; WURTH; KOORDERS no. 43824 β, Sh. 2500 m); Res. Pekalongan: Urwald nw. Prahoe bei Sidjaran Sh. 200 m (KOORDERS no. 11219 β,); Nordabhang Dieng Sh. 1900 m (BACKER 21893); Josoredjo Sh. 1400 m (BACKER no. 16060); Res. Preanger: Gede, bei Tjibodas (KOORDERS no. 25847 β); Garoet (BURCK); G. Papandajan, G. Goentoer, Sh. 900 m (BACKER no. 5234); Bandoeng, W. Patoeha bei Rantja Soeni, Sh. 1650 m (LÖRZING no. 1317); Tirtasari, Sh. 1500 m (J. J. SMITH et RANT no. 163); G. Malabar (MONTERI no. 47); Tjinjiroean ± 1500 m (DOCTERS VAN LEEUWEN); G. Wajang (SCHEFFER); Res. Semarang: Ufer des Kali Moentoel südl. Rawah Pening Sh. 460 m (BACKER no. 30170); nw. Moeriah Sh. 400 m; (DOCTERS VAN LEEUWEN no. 701); bei Sepakoeng 1300 m (KOORDERS 35881 β); Urwald Telomojo (KOORDERS no. 27834 β); Res. Soerabaja: G. Andjasmoro Sh. 1980 m (BACKER no. 28); Res. Soerakarta: G. Andong bei Sidjaran Sh. 1100 m (DOCTERS VAN LEEUWEN no. 146).

Molucken: Insel Ambon (ROBINSON no. 2031); Insel Soela besi, Tandj. Baleha (V. HULSTIJN no. 234); Insel Ternate Ngadè Sh. ± 15 m (BEGUIN no. 1680). Insel Boeroe, Fakal Sh. 1200 m (TOXOPEUS).

Sumatra: Res. West-Küste: G. Koerintji Sh. 2000 m (BÜNNEMEIJER no. 9254); Karohochebene, Nordfuss d. Sinaboeng Sh. ± 1400 m (LÖRZING no. 8766).

Kultiviert im botan Garten zu Buitenzorg: XV J. A. XXXI 3.

Buitenzorg, am 27. Febr. 1922.

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NACHTRAG.

Nach Abschluss meines Manuskripts gelangte noch ein Sonderdruck einer Arbeit von E. D. MERRILL „Alabastra Borneensia" (Journ. Straits Branch R. A. Soc. No. 77, 1917) in meine Hände, dessen Inhalt ich nicht unberücksichtigt lassen kann.

Fagraea stenophylla BECC. Nelle Foreste di Borneo (1902) 524, fig. 65, 1 (402); MERRILL a.a. O. 236.

Die kurze Beschreibung MERRILLS, sowie die photographische Wiedergabe eines einzigen Blattes bei BECCARI sind die einzigen Berichte über diese neue Art, die mit der von mir aufgestellten Art *F. eucalyptifolia* möglicherweise identisch ist. Die auffallende, bei *Fagraea*-Arten ungewohnte Form der Blätter sprechen sehr für diese Annahme. Sollte sich die einwandfreie Gleichheit dieser beiden Arten ergeben, so wäre der von mir gegebene Name als der jüngere einzuziehen.

Fagraea uniflora MERRILL Alabastra Borneensia in Journ. Straits Branch R. A. Soc. No 77, 1917, 235.

Ich halte diese Art trotz ihrer auffallenden, bei *Fagraea* ungewohnten Zahl der Kelch- und Blumenkronlappen nach der übrigen Beschreibung für *F. carnosa* JACK = *F. monantha* MIQ. Es ist wahrscheinlich, dass es sich um eine monströse Blütenform handelt. Auch hier könnte ein Vergleich der übrigen Artmerkmale Aufschluss geben. Die Angabe der Kelchlänge

ist ungenau, da sie einmal mit 3 cm, auf Seite 236 mit 5 cm festgesetzt ist. Bei meinen Exemplaren von *F. carnosa* ist der Kelch 3 cm lang. Letztere Art kenne ich allerdings nur von Sumatra.

Fagraea grandifolia MERRILL Alabastra Borneensia in Journ. Straits Branch R. A. Soc. No. 77, 1917, 231.

Was ich über die grosse Varabilität der Blätter und Blütenstände bei *F. racemosa* gesagt habe, würde vielleicht auch für die neue Art die Zugehörigkeit zu *F. racemosa* JACK ergeben. Ich hebe noch einmal hervor, dass es unmöglich ist, die zahllosen razemösen Arten als gute Arten aufrecht zu halten und dass man einige zu einer grossen Art, *F. racemosa*, vereinigen muss, da sie durch alle Übergänge der Blattgrösse und Blütenstandsgrösse mit einander verbunden sind. Nur auffallend anders geformte Blätter berechtigen zur Aufstellung eigener Arten in dieser Gruppe. Dasselbe mag auch für **Fagraea cymosa** MERRILL Alabastra Borneensis in Journ. Straits Branch R. A. Soc. No. 77, 1917, 234 gelten.

Buitenzorg, im October 1922.

PHRYNIUM OBSCURUM T. et B.

Eine noch unvollständig bekannte Marantacea.
(*Neue Beschreibung nach der lebenden Pflanze*).

von

Th. VALETON.

Mit Tafel 38.

PHRYNIUM OBSCURUM T. et B.! in Nat. T. Ned.-Indië, **24** (1862), 329; K. SCHUM. in Pflz. reich IV, 48, (1902), p. 57.

Herba subglabra, fere metralis. Folia basalia longe compresse petiolata, maxima, oblonga, basi acuta, apice breviter acuminata, in vivo supra viridia subtus atropurpurea, in sicco tota olivacea, costa media subtus rubescente, glabra, petiolo supra articulationem minute dense puberulo.

Scapus nudus (i.e. folio destitutus) semimetralis. Capitulum bracteatum terminale, oblongum, bractea externa (vagina sensu K. SCH.) ipso subaequilonga, amplexicauli, ovata, longe acuminata, parte basali subcoriacea, parte superiore membranacea, sterili, vaginatum.

Bracteae fertiles numerosae imbricatae, internodiis brevibus separatae, semiamplexicaules spiraliter insertae et sese semiamplectentes, late ovatae acutae concavae, parte 1/3 superiore membranacea cito marcescente et lacerata. Bracteola praeposita pro quaque bractea singula, parva, lanceolata, tenuiter membranacea. Inflorescentiae speciales 6-florae, e paribus compositae, floribus sessilibus et basi conjunctis, prophyllis mono- bi- et tricarinatis, floribus aequilongis, aliisque brevioribus ecarinatis intermixtis.

Flores modice pedicellati. Ovarium hirsutum. Sepala paullum inaequalia, anguste lineari-lanceolata, elongata. Corollae tubus elongatus, sepala aequans. Petala spathulato-linearia revoluta. Staminodia externa tria, valde inaequalia, unum obovatum apice retusum, margine in vivo recurvo, secundum oblanceolatum apice rotundatum, praecedenti aequilongum sed multo angustius, tertium (labellum sive staminodium callosum) maximum obovatum apice rotundatum et recurvum, in vivo complicatum et genitalia includens, petaloideum, parte 1/4 inferiore callosum et excavatum, per anthesin stigma cum cucullo appresso fovens, callus parte basali dense sericea. Stamen cucullo circ. aequilongum, antherae theca petaloidea oblonga, parva, fertilem paullum superans. Stigma generis. Capsula sat magna obovato-trigona, trilocularis trisperma vel abortu disperma, pericarpio crasso sublignoso apice 6-sulcato et tarde dehiscente. Semina oblonga tegmine leviter corrugato, arillo parvo appendiculis insignibus appressis S-forme curvatis.

Die Pflanze besteht aus einem Basalblatte und einem schon am Boden aus dem Tragblatte hervortretenden 450 bis 500 mm langen, nackten Blütenstengel. Blattstiel bis 500 mm lang, unbehaart, nur der obere callusartige Teil, 60 bis 70 mm lang, am Nodus sehr fein behaart. An dem unteren Teil treten beim Trocknen kleine amorphe Conglomerate hervor, die sich in Salzsäure nicht lösen, wodurch der Stiel warzig punktiert erscheint. Blattspreite 500 mm bei 150—170 lang, unterseits purpurbraun, oberseits dunkelgrün. Das Köpfchen ist eine abgekürzte Aehre, länglich, 60 bis 70 bei 40 mm lang und besteht aus einer groszen Anzahl spiralig über einander gestellter und imbricater fertiler Bracteen, alle zusammen von einer grösseren, sterilen, amplexicaulen Bractee scheidenförmig umhüllt. Letztere ist 60 bei 30 mm lang, an der Basis wie der Stengel mit sehr dünnen anliegenden Haaren bekleidet, im unteren Teil fleischig-lederig, im oberen Drittel häutig, in eine lange fleischige Spitze ausgehend (Rudiment der Blattspreite). Die untere fertile Bractee ist etwa 5 mm über der vorigen inseriert, halbstengelumfassend, länglich, spitz, concav, im oberen Teil häutig trocken, bald der Länge nach zerschlitzt und zerfetzt, 50 mm lang. Die nächstfolgenden sind von derselben Gestalt und nehmen nach oben an Grösze ab, die fleischige Achse ist etwa 30 mm lang. Jede Special-Inflorescenz besteht aus 6 gestielten, dichtgedrängten und nicht oder undeutlich paarweise vereinten, gestielten Blüten, welche von zahlreichen 1—2 und 3 mal gekielten Prophyllen und kleineren, ungekielten Bracteolen untermischt sind. Die ersteren werden sehr bald mazeriert, sodasz nur die Nerven erhalten bleiben während der Blüte, sodasz es mir nicht gelungen ist, ihre Zahl und Stellung genau zu constatieren, mutmaszlich giebt es deren 12. Die gekielten sind 25 bis 35 mm lang, die ungekielten etwas kleiner. Merkwürdig ist, dasz sich ein ähnliches kleines, häutiges, lanzettliches, ungekieltes Vorblatt vor der Bractee befindet.

Die Blütenstiele wechseln zwischen 3 und 10 mm in Länge. Die Blüte ist 32 mm lang. Der behaarte Eierstock ist 2 mm lang. Die lineal-lanzettförmigen Sepala sind ungleich, 18 bis 19 mm lang, die Corolla 28 mm lang, die unteren 13 mm mit dem Genitaltubus verwachsen. Die Lappen etwa 15 mm lang, revolut. Äussere Staminodia und Callusblatt (Labellum) petaloid (Fig. 14), das erste obovat, tief emarginat mit abgerundeten Lappen, 10 mm lang und 5 breit, der Oberrand recurv. Das zweite oblanceolat, abgerundet, 8 mm lang, 3 mm breit, das dritte (Labellum = Callusblatt, Fig. 2) grosz, petaloid, obovat, 13 mm lang, 8 breit, es umfasst die Genitalien scheidenförmig (Fig. 17) und der Oberrand ist recurv, einem Hufeisen ähnlich, das innere untere Viertel ist fleischig und an seinem Oberrand frei, es bildet den eigentlichen Callus und hat in der Mitte eine Höhlung, in welcher das Stigma eingefasst ist. Der untere Teil ist seidig behaart. Der gegen das Stigma angedrückte und gleichlange Cucullus ist halb kreisrund und mit dem dicken Stiel etwa 10 mm lang; der 5 mm breite Laminateil ist steif, fächerförmig gefaltet und geht seitlich in eine nach unten gerichtete Spitze aus (sogenannter Anhang). Das Stamen ist zwischen den Cucullus und das kleine Std. gestellt; die Anthera, 1 mm lang, mit dem seitlichen, ihm in Gestalt ähnlichen, etwas grösseren, petaloiden Anhang, treten gerade über dem Cucullus heraus (siehe Fig. 14.)

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

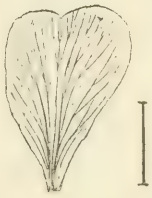


Fig. 18.

Das Stigma ist cylindrisch, vorn abgestutzt mit einer kleinen gelben Stigmafläche schief nach oben, es biegt sich in der jungen Blüte nach vorn, später krümmt es sich nach unten.

Alle Blütenteile sind weisz, violett-getüpfelt, die Narbe ist rot, die Anthere gelb.

Die Frucht ist obovat-dreieckig, 12 × 12, die 3 Klappen sind 1 mm dick, hart, fast holzig und verlieren die ursprüngliche Behaarung, die Farbe ist hell-rötlich braun. Die 3, seltener 2, Samen sind schwarz-braun mit dünner, quergestreifter Samenhaut. Der kleine, gelbliche, die Unterfläche deckende Arillus hat zwei verhältnissmäszig grosze, gekrümmte, mit der convexen Seite sich berührende Anhänge. Ob dieselben sich beim Aufspringen der Frucht ausbreiten und als Schwellkörper fungieren, ist nicht beobachtet.

Diese Art, welche ohne Zweifel sehr nahe verwandt ist mit den beiden Neu-Guinea-Arten *Phrynium macrocephalum* und *pedunculatum* K. SCH., würde nach der Umschreibung K. SCHUMANNS (siehe l. c. p. 31) nicht zu *Phrynium* gehören, sondern zu einer neuen Gattung zwischen *Afrocalathea* und *Phrynium*; das Std. callosum ist nämlich wie bei der ersteren Gattung sehr grosz und petaloid; in den sitzenden Blütenpaaren und gestielten Blüten jedoch, dem ungleichen Auszen-Staminod, sowie in der Verteilung

der Prophylla unterscheidet sie sich von beiden Gattungen und scheint sich *Phacelophrynium* K. SCH. zu nähern, welches sich ebenfalls durch den groszen behaarten Callus auszeichnet, sich aber wieder durch die Zahl der Auszenstaminodien sowie durch die lockere Inflorescenz unterscheidet. Eine neue Untersuchung der noch wenig bekannten Arten *Ph. maximum* und *longispicum* wird vielleicht nähere Beziehungen zwischen diesen Arten und den 3 abnormalen *Phrynium*-Arten anweisen.

FIGUREN-ERKLÄRUNG

Tafel 38.

Fig. 1: Habitusbild, viele Male verkleinert. Fig. 2: Inflorescenz, nat. Gr. Fig. 3: Dieselbe, im Fruchtzustand. Fig. 4 u. 5: Blüte, nat. Gr. Fig. 6: Bl., in der Länge aufgeschnitten. Fig. 7: Saum und Sexualorgane, 3 × nat. Gr. Fig. 8: Kelch-Segmente. Fig. 9: Bracteen, schon zerfetzt. Fig. 10 u. 11: Kapsel. Fig. 12: Dieselbe, im Querschnitt. Fig. 13: Samen.

Figuren im Text.

Fig. 14: Limbalteil der Blüte, zweifach vergröszert, ein wenig ausgebreitet, man sieht die beiden sogen. Auszenstaminodien und rechts das Labellum (Callus-staminodium), mit der unten und seitlich behaarten Anschwellung in deren Höhlung das Stigma und seitlich das Cucullär-Blatt und einen Teil der Anthere.

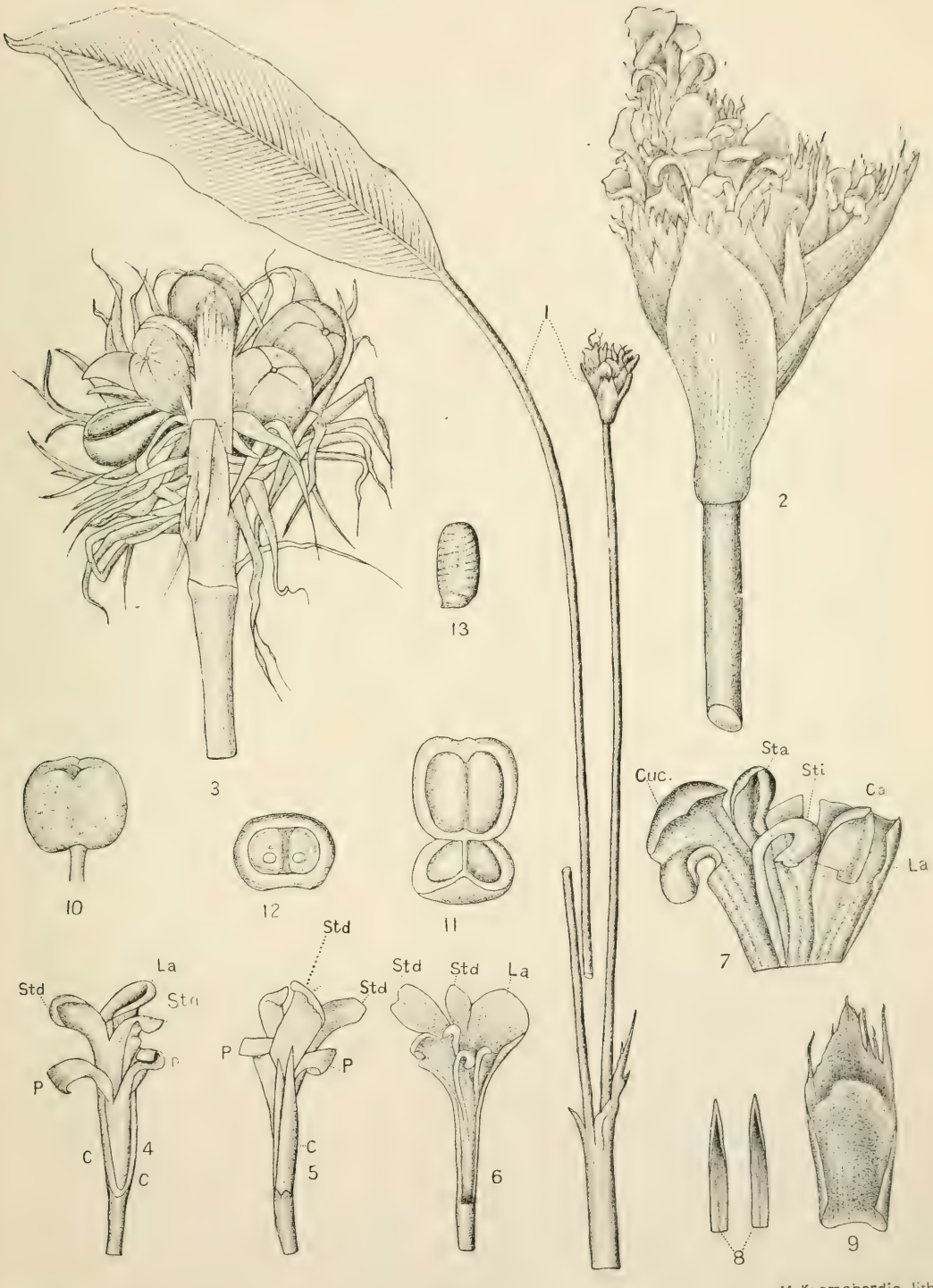
Fig. 15: Das Labellum flach ausgelegt, dreifach vergr.

Fig. 16: Genitalien und Cucullärblätt von der Innenseite. Hinter und seitlich von der Anthere die gleichgrosze, petaloide, zweite Theke.

Fig. 17: Das Labellum im natürlichen Stande, hufeisenähnlich gefaltet, die Genitalien mit dem Cucullus, welcher das Stigma umfasst, rechts hervor gezogen. Das Staubblatt zeigt die fertile Theke links, die petaloide rechts; links das mittlere, schmale Staminodium etwa 3 × vergröszert.

Fig. 18: Das gröszere der äuszeren Staminodien, etwa 2 × vergröszert, abgelöst.

Die Figuren im Text sind von J. BIEGELAAR, Zeichner beim Rijksherbarium zu Leiden, angefertigt.



R. Natadipoera del.

M. Kromohardjo lith.

Phrynium obscurum T. et B.

ALPINIA HULSTIJNII, VAL. nov. spec.
(Zingiberaceaeae)

von

Th. VALETON.

Mit Tafel 39.

ALPINIA HULSTIJNII VAL. n. sp.

Herba subglabra erecta. Folia ovata vel oblonga attenuata brevi-acuminata, basi in petiolum mediocrem decurrentia, ad summum 200 mm longa. Ligula parva biloba lobis rotundatis. Racemus laxiflorus simplex rachi ebracteato, floribus brevissime pedicellatis, vulgo irregulariter geminatis albo-roseis. Calyx late vaginatus tridentatus pubescens. Corollae tubus brevis lobis linearibus apice cucullatis rotundatis erectis. Labellum corollae lobis longius, rhombiformi-obovatum subtrilobum, lobis rotundatis, mediano ante petala exserto lateralibus erectis. Stamen petalum excedens. Filamentum lineare. Anthera ovata loculis angustis contiguis, appendiculo insigni rotundato concavo, ipso multo breviore, stigma inclusum excedente. Staminodia linearia filamento paullum breviora, basi illo adnata.

Kleine, aufrechte Pflanze 400 bis 600 mm hoch (aus Samen gezüchtet). Scheinstamm 160 mm, mit einer braunen Scheide nahe der Basis und 6 gestielten, eiförmig-länglichen oberseits dunkelgrünen, sehr glänzenden, etwas fleischigen Blättern mit 6—10 Paar oberseits etwas hervortretenden Nerven. Höchstes Blatt 200 × 70, Blattstiele von oben nach unten 70—20 mm lang. Ligula-Lappen 5—6 × 4 mm lang, braun, wie die Innenseite des Petiolus. Traube etwa 120 mm lang, 12-blütig, der Hauptstiel von einer anschliesszenden Vagina eingeschloszen, die sehr kurzgestielten Blüten in Paaren rund um die Axe gestellt. Gemeinsame Bractea mit weiszer Scheide und etwa 50 mm langer, schlaffer, blassgrüner Lamina. Die Bracteolen sind obsolet oder sehr früh verschwunden. Rachis weisz. Blüte 30 bis 40 mm lang, aufsteigend, der Kelch scheidenförmig, breit 3-zähnig, weisz, pubescent, 17 × 7 mm. Kronröhre 8 mm, die weiszen Petalen lineal, etwas concav, kürzer als die Lippe und dieser seitlich angedrückt. Dorsales Petalum 25 mm, Seitenpetala 20 mm × 3—4. Labellum nachenförmig mit groszen Seitenlappen, während der Vollblüte (in den Morgenstunden) der Mittel-Lappen vorgestreckt, ausgelegt rautenförmig, stumpfeckig, hellrosa mit breitem, weiszem Mittelfeld mit dunkel punktierten Fiederstreifen, 32 mm × 20, der Blütengrund blaszgelblich. Filament lineal, 20 mm, weisz. Staminodien lineal, rot, 15 mm lang, aber zur Hälfte dem Filament angewachsen und mit demselben eine breite, behaarte Rinne bildend. Die introrse, eiförmige Anthere hat sehr schmale, sich berührende Spalten und

dicke, fleischige Auszenwände. Das dorsale Connectiv endet in eine abgerundete, hohle, eiförmige Crista (Appendicula, SCHUM.) (siehe fig. 8 u. 7). Das Staubblatt biegt sich bald nach dem Öffnen der Blüte nach vorne gegen das Labellum und verschlieszt mit den Seitenlappen den nackten Schlundeingang.

Vorkommen: Sanana auf der Insel Sula besi, östlich von Celebes. Die Pflanze wurde am 27. Jan. 1915 im Bot. Garten zu Buitenzorg, gesät, und blühte am 26. Nov. zum ersten Male.

Anm. Diese Art gehört mit *A. Warburgii* K. SCH., *A. rubricaulis* K. SCH., *A. padacanca* VAL. *), und *A. versicolor* K SCH. zu einer kleinen Gruppe soweit bekannt in Celebes endemischer Arten, die in der Gattung charakterisiert sind durch die Obliteration der Seitenaxen der Pannikel, wodurch die kurzgestielten Blüten direkt an der Hauptaxe inseriert sind, meist jedoch wieder in kleinen Complexen auf gemeinschaftlicher Basis, oder in Pseudowirteln. Die Bracteen der Seitenaxen (Primärbrakteen K. SCHUM.) sind zugleicher Zeit gänzlich oder fast gänzlich reduziert, die Gruppe gehört also in die heterogene Untergattung *Probolocalyx* (Pflanzenreich, p. 325). Die Gruppe zeichnet sich weiter aus durch den groszen, hohlen, unbehaarten Antherenanhang und die im Verhältnis groszen, schmalen Staminodien.

Unsere Art ist mit *A. Warburgii* sehr nahe verwandt; dieselbe unterscheidet sich hauptsächlich durch die gröszeren Abmessungen sowie durch die Blattform und auch durch die kleineren Staminodien. Es kann sein, dasz diese Verschiedenheiten bei weiterem Auswachsen der Pflanze verschwinden werden.

In SCHUMANNS Schlüssel der *Alpinia*-Arten ist unsere Art in folgender Weise einzureihen:

a Flores solitarii vel spurie geminati:
β Inflorescentia racemosa vel spicata:
II Inflorescentia laxior, flores inter se remoti:
2 Connectivi appendicula exstans, labellum obovatum (subrhombiforme):
* Connectivi app. ovata integra, folia utrinque glabra:
1 Folia ad 4 mm longa 50 mm lata lineari-lanceolata longe caudata, staminodium parvum . . . . . *Alpinia Warburgii.*
2 Folia ad 200 mm longa 70—55 mm lata, oblongo- vel ovato-lanceolata; staminodium elongatum . . . . . *Alpinia Hulstijnii.*
** Connectivi app. obovata subtriloba; staminodia lanceolata; folia glabra margine pilosula 500 mm longa, 120 mm lata: . *Alpinia rubricaulis.*
*** Connectivi app. lata apice irregulariter dentata; staminodia subulata subincurva folia glabra margine scabro acumine pilosulo; 200 mm longa 35—40 mm lata . . . . . *Alpinia padacanca.*
**** Connectivi app. apice crenulata staminodia subulata; folia subtus subtomentosa. . . . . *Alpinia versicolor.*

Geographische Verbreitung der Arten. *A. Warburgii*: Nord-Celebes bei Bodjong (WARB. 15736!) — *A. Hulstijnii:* Insel Sula Besi, an der Ostküste von Celebes bei Sanana (v. HULSTIJN n. 205!) — *A. rubricaulis:* Celebes bei Tomohon (Vettern SARRASIN n. 202!) — *A. padacanca:* Ost-Celebes bei Punku (BEGUIN n. 988!) — *A. versicolor:* Celebes bei Masarang (Vett. SARRASIN n. 229) und bei Bodjong (WARBURG 15735!).

*) Siehe HEYNE „De nuttige Planten etc." Dl. I, tweede uitgave 1922).

FIGUREN-ERKLÄRUNG.

Tafel 39.

Fig. 1. Inflorescenz einer 6 Monate alten Pflanze. Zur Linken: Scheide des vorletzten Blattes, halbe Grösze.
Fig. 2. Blüte, nat. Gr.: a Eierstock, b Kelch, c linker Seitenlappen der Corolla, d Rückenlappen, e Labellum, f Anthere mit der Appendicula und dem Stigma, g Staminodium.
Fig. 3. Blüte von der Rückenseite, nat. Gr. é Seitenlappen des Labellum.
Fig. 4. Blüte nach Fortnahme der Seitenlappen, nat. Gr.; p.d. Dorsallappen; st. Staminodien, nat. Gr.
Fig. 5. Kelch von der Rückenseite, nat. Grösze.
Fig. 6. Labellum ausgebreitet, nat. Grösze.
Fig. 7. Stamen mit Stilus und Staminodien, 2×.
Fig. 8. Oberer Teil des Stamen, 2×.
Fig. 9-10. Anthere in einem jungen und älteren Stadium, 2×.
Fig. 11. Stigma, 5×.

R. Natadipoera del.

M. Kromohardjo lith.

Alpinia Hulstijnii Val.

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